RACE SPACE: THE TRANSFORMATION OF ICONIC MOTORSPORT CIRCUITS FROM PUBLIC USE TO LARGE TECHNICAL SYSTEMS, (1950-2010)

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DEDICATIONS

I dedicate this dissertation to the teachers who impacted my life's development. At Elroy Elementary School in the Brentwood suburb of Pittsburgh Mrs. Higginbotham and Mrs. Pappas both challenged me and enabled learning. The faculty of SHAPE International High School's Belgian section during my year in the Quatriéme (4éme) Moderne stretched my conception of what I thought was a conventional program by requiring Biology, Chemistry, Physics, Macroencomics, Microeconomics, Math, French, German, English, Physical Education, Art, Music, Religion, History, and Geography classes all in one week. Four years of French in high school with Ms. Dee Moynihan (cousin of legendary statesman Daniel Patrick Moynihan) were inspiring and my twelfth-grade Advanced English teacher Ms. Virginia Crane, made learning the subtleties of literary language fun by referring to our student row of end-of-alphabet names as the "black-bird row" as we questioned almost everything.

Closer to my heart, I dedicate this to my family of teachers. My parents' dear friends Lasse and Brita Olsson, my uncle Sven-Erik Lidén as a school administrator, my godparents Gunnar and Brita Liss, my aunt Kerstin Westin, my mother Anna-Lisa (Ekvall) Westin, and my paternal grandfather Dr. Per Gunnar Westin. *Pax vo biscum.*

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During my initial interview with Prof. John Krige regarding admission into the Georgia Tech HSTS program, in the first two-three comments I made it clear that my focus was to bring my professional work experience with historical case studies to teach undergraduate engineers. I am now doing this.

Completing the journey resulting in the following narrative could only have happened with the help of many people along the way. First, I am obligated to memorialize three people who greatly impacted me but are no longer with us. The late Ann Johnson was the first person in our profession, and outside of Georgia Tech, to whom I broached my motorsport-centric path and instead of doubt and hesitation, she wholeheartedly encouraged me. My dear friend and colleague, Wayne Drews, showed me that senior non-traditional students can succeed and he gave me an opportunity to guest lecture. I also want to thank Col. “Duke" Kane, PhD and his family for allowing me to interview the expert, in his home, on initial GPS implementation. Most importantly, I must thank my parents for raising an inquisitive, stubborn, and unrelenting son by exposing me to so many cultures and ideas. While not physically here, they are with me and I miss them greatly.

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This venture would not have been completed without the support of my colleagues. I begin with Joe Lupton, another of our senior, non-traditional entourage. Our conversations continuously refreshed my purpose and I am profoundly thankful to him. I also drew strength from members of my cohort Jennifer Green, Rebecca Hull, and Jonah Bea-Taylor.

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To the reader, whatever mistakes, errors, or omissions might exist, they are mine and mine alone.

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LIST OF SYMBOLS AND ABBREVIATIONS

ACCUS	Automobile Competition Committee for the United States
ACF	Automobile Club de France
BE	Bernie Ecclestone (in Formula One)
DTM	*Deutsche Touring Motorrennen* (German racing series)
EU	European Union
F1	Formula One
FIA	*Federation International de l'Automobile*
GT	Grand Touring
GP	Grand Prix
ICE	Internal Combustion Engine
IMRRC	International Motor Racing Research Center
IRL	Indy Racing League
M/S	Motorsport(s)
MSV	Motor Sport Valley (in England)
NASCAR	National Association for Stock Car Automobile Racing
RB	Regenerative Braking
SCCA	Sports Car Club of America
SEMA	Specialty Equipment Manufacturers of America
USAC	United States Auto Club
WEC	World Endurance Championship
WGI	Watkins Glen International
WRC	World Rally Championship

SUMMARY

The 1950s marked the beginning of a key transformational period in automobility and the socio-technical realm of motorsports. In Post-War Europe, people began to drive for pleasure on weekends and holidays while in the US, this extant access was supplanted by the quest for more status-oriented and powerful cars. On both continents it was also the time when motorsporting activities became formally organized and regulated with the creation of the globally oriented Federation Internationale de L'Automobile (FIA) in Paris, France and the American oriented National Association for Stock Car Automobile Racing (NASCAR) in Daytona Beach, Florida (US).

This chronicle is a transnational examination of motorsport's place in automotive technology and culture as well as of unique motorsport sites with physically shifting landscapes and tensions that cascaded across socio-cultural strains, technological innovation, and regulation. I locate this ambitious narrative at an intersection where several themes are fused together incorporating my interpretation of Thomas Hughes' concept of large-technical systems in conjunction with Manuel Castells' notion regarding highly technical nodes of a transnational business network, environ-mental complexity, easier mobility in Europe and America from proliferation of roadway networks, postwar consumption and increased "time budgets" coupled with technological enthusiasm, and coproduced hegemony instrumental to this evolution. Over time these would coalesce into a heterogenous network reliant upon multiple actors.

According to Hughes's model there are four phases: invention and development, inter-regional technology transfer, system growth, momentum. While not yet a transnational

network in the first phase, motorsports grew to become inextricably intertwined globally. This growth also complicated the relationship between technology, regulation, and the environment. Further as people earned more (especially in Europe) they learned to be a consumer and with more free time they could take vacations and drive to races. Enthusiasts formed social networks and communities of DIY car clubs, fan clubs, clubs for specific automotive brands, amateur driving clubs, and Specialty Equipment Manufacturers Association (SEMA). Active participants who were initially hobbyists and mechanics transformed into professional drivers and engineers as they learned to apply scientific principles like fluid dynamics, and methods like modeling to designing very complex machines.

CHAPTER I – INTRODUCTION: SETTING THE GRID

In 2005, economic geographers Nick Henry, Tim Angus, et al., published the book *Motorsport Going Global*, which is the most recent empirically compiled data on the industry. Their research spans from macro-level statistics down to individual nations. At the global niveau they revealed that motorsport had, at that time, an annual global economic impact greater than $80-billion USD (£50-billion GBP) with more than one million certified racing drivers and tens of millions of fans worldwide, and that it was growing. [1] How did this enormous industry come to exist?

When people think of motorsports (M/S), it is likely the mental imagery is that of television footage or still pictures showing spectacular or fiery crashes and drivers envisaged as heroic for surviving an incident or a physically and mentally demanding race. Thus it would be tempting to believe the story of this industry is one of cars and drivers. In this study I will argue instead that it was far more than these two components, cars and drivers, it was much more complex and nuanced. To fully comprehend the rise of this massive business, it useful to think about M/S as a complex technological system. This system, I argue, was comprised of several sub-themes fused together incorporating my interpretation of Thomas Hughes' concept of large-technological systems[2] in conjunction with Manuel Castells' notion regarding highly technical nodes of a transnational business network,[3] environmental complexity, greater mobility in Europe and America from postwar

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[1] N. Henry, Angus, T., Jenkins, M., Aylett, C., *Motorsport Going Global* (Hampshire: Palgrave MacMillan, 2007). Page x

[2] Thomas P. Hughes, *Networks of Power : Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983).

[3] Manuel Castells, *The Rise of the Network Society*, 2nd ed. (Malden: Wiley-Blackwell, 2010). Specifically chapters 2,3, and 6.

proliferation of roadway networks,[4] postwar consumption and Arnulf Grübler's discussion of increased "time budgets" coupled with technological enthusiasm,[5] and coproduced hegemony were essential to this evolution.[6] This study is a transnational examination of motorsport's place in automotive technology and culture as well as of unique motorsport sites involving physically shifting landscapes and tensions that cascaded across socio-cultural strains, technological innovation, and regulation. Over time these would coalesce into a heterogenous network reliant upon multiple actors.

According to Hughes, the model of a large technical system is "subject to influences from the environment" it is in and which is "[c]entrally directed, [with] interacting institutions and technical components."[7] He also informs that it consists of four phases which, in sequence, "inventor-entrepreneurs who differ from ordinary inventors"; "the process of technology transfer from one region or society to another"; "system growth"; and "substantial momentum" whereby "considerable capital has been invested".[8]

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4 Frank Schipper, *Driving Europe: Building Europe on Roads in the Twentieth Century* (Amsterdam: Aksant, 2008). Chris Wells, *Car Country: An Environmental History* (Seattle: University of Washington Press, 2012).

5 Arnulf Grübler, *Technology and Global Change* (Cambridge: Cambridge University Press, 2003); S. Strasser, Judt, M., ed. *Getting and Spending: European and American Consumer Societies in the Twentieth Century* (Cambridge: Cambridge University Press, 1998)., Richard Pells, *Not Like Us: How Europeans Have Loved, Hated, and Transformed American Culture since World War Ii* (New York: Basic Books (a division of HarperCollins Publishers, Inc.), 1997)., Eric Hobsbawm, *The Age of Extremes: A History of the World, 1914-1991* (New York: Vintage Books, 1994)., Tony Judt, *Postwar: A History of Europe since 1945* (New York: Penguin Books, 2005)., , Stefan Poser, "Leisure Time and Technology," *European History Online* (2011), http://www.ieg-ego.eu/posers-2010-en., Peter Westin, "Motorsports and the Motoring Public at Full Song (1950 to 1965): Measuring Men, Creatively Destroying, or Stimulating Technology?," *Technology and Culture* Technologies Stories, no. August (2015).,

6 John Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe* (Cambridge: MIT Press, 2006). Tom Bower, *No Angel: The Secret Life of Bernie Ecclestone* (London: Faber & Faber, 2011)., , Daniel S. Pierce, *Real Nascar : White Lightning, Red Clay, and Big Bill France* (Chapel Hill: University of North Carolina Press, 2010)., Herbert A. Branham, *Big Bill : The Life and Times of Nascar Founder Bill France Sr* (New York: Penguin Random House, 2015).

7 Hughes. Page 6

8 Ibid. Pages 14 – 15

More importantly, as in Hughes' examination of electric power development and distribution, regional cultures were seminal in how distinct utility systems evolved in Berlin, Germany, Chicago in America, and London, England, there were commonalities for all three which transcended national boundaries like "international pool of technology", "scientific and technological literature", "courses in engineering schools", and cross-border movement of engineers and inventors. There were also significant and differing nontechnological cultural factors in those disparate regions which he referred to as regional styles.[9] This important dimension of the cross-national approach he undertook also had a large bearing in the evolution of M/S and I expand on his theme further by adding consumers and the physical landscapes of racetracks. Furthermore, unlike electrification technological systems, M/S requires several hierarchical layers of social groups – active, administrative, and enthusiast participants. It is equally important to understand that, unlike many SCOT narratives, in this study power is not shared equally, nor is wielded equally.

As will be shown in the following narrative, what began as a loose affiliation of people and places in 1950 developed into a global heterogeneous network of highly technological systems. American stock car racing began with strong ties to the production and transportation of illegally produced alcohol in the Piedmont and Appalachian regions of southeastern states, despite efforts to minimize that well-known information. In Europe, wealthy hobbyists and car companies competed in endurance road races lasting many hours. Nation-state supported car companies took part in in the most sophisticated road

[9] Hughes. Page 405

racing in Formula One until British until British independents shattered the power paradigm for both cars and who wielded that power.

This evolution encompassed complex social groups, production and regulatory centers, technical innovation, as well as micro and macroeconomics, contested on particular landscapes. The car was merely the very complicated artifact manipulated to become an industry known as M/S and, like Hughes' study of electrification, it was special inventors and entrepreneurs with their technological innovations who created the systems. Primary among them, it was the vision of two system builders named Bill France in the United States with National Association of Stock Car Auto Racing (NASCAR) and Bernie Ecclestone (hereafter as BE) with Formula One (hereafter as F1) in Europe initially, then on a global stage. Furthermore, as will be revealed, it was only through their tight control over these organizations that M/S became the massive business it is today. As vital as these two men were to M/S, they were like the cars and drivers, major components of the broader complicated story.

This dissertation is about the relationships between M/S as a sport, automotive production, car culture, automotive technology and regulation, technology and the environment, M/S culture, and M/S technologies, as it took place simultaneously on both sides of, and traversed, the Atlantic.[10] Automobility is defined for this narrative as both manufacture and use of the car by the driving public because results of production influenced buying

[10] On technology and the environment please see, William Cronon, "Modes of Prophecy and Production: Placing Nature in History," *Journal of American History* 76, no. 4 (1990). As well as Richard White, "Afterword Environmental History: Watching a Historical Field Mature," *Pacific Historical Review* 70, no. 1 (2001). And Sverker Sörlin, Warde, Paul, "The Problem of the Problem of Environmental History: A Re-Reading of the Field," *Environmental History* 12, no. 1 (2007)., JR. McNeill, Unger, C., ed. *Environmental Histories of the Cold War* (Cambridge: Cambridge University Press, 2010). Plus C. Sellers, Melling, J., ed. *Dangerous Trade* (Philadelphia: Temple University Press, 2012).

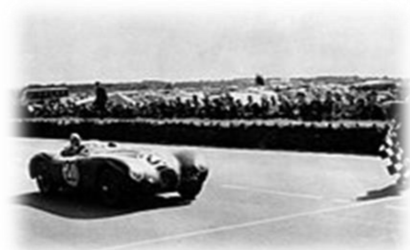
decisions and affected how the driver used the car. Nodes of a transnational network were not initially distinct but they became inextricably intertwined across distant spaces with global brands in a capitalist system. As people earned more they learned to be consumers (especially in Europe) and as they had more free time they went on vacations driving on the newly formed roadway networks, sometimes to racing venues. Enthusiasts of M/S formed social networks and communities engaged in car maintenance/customization, regional car clubs, and clubs for particular marques.

In the early decades, truly unified regulation and sanctioning authority over motor racing was minimal in Europe and nominally administered in the USA by the American Automobile Association (AAA), but as of 1949 that all changed. In America, that was the first year of competitive racing under the banner of NASCAR[11] (Fig. 1-1) while in Europe it was the pronouncement that the Federation Internationale de l'Automobile (FIA), effective the 1950 season, would oversee Formula One open-wheel motor racing worldwide under the "World Drivers Championship" (Fig 1-2).[12] The former based itself

(Fig. 1-1) 1958 Ford Thunderbird leading a NASCAR race (unidentified track).
https://commons.wikimedia.org/wiki/File:Nascar_race_from_the_1950s.jpg

[11] Initially, American-centric, NASCAR grew to include some motorsport series in Canada and Mexico.
[12] In 1959 ACCUS (Automobile Competition Committee for the United States) was formed as a central liaison between the FIA and various American racing bodies including NASCAR. For this writing it has no major significance and will not be discussed further.

Fig. 1-2: Alberto Ascari and Luigi Villoresi in action at the 1952 Italian GP. Both are driving Ferrari Tipo 500s.
https://commons.wikimedia.org/w/index.php?curid=11949262



(Fig. 1-3) Peter Whitehead crosses the line to win the 24 Hours of Le Mans race in 1951, aboard the winning Jaguar C-typehttps://commons.wikimedia.org/w/index.php?curid=32358348

in Daytona Beach, Florida (USA), the latter in Paris, France. Whereas both entities have controlled multiple categories and levels of racing, the focus here will be on the three top tier series known as the FIA's Formula One (F1) and World Endurance Championship (WEC)[13] (Fig. 1-3), and the currently monikered NASCAR's Monster Energy Cup.[14] The reason for exploring only the top tier of each type of racing is purely logistical in that a) the most experienced level is also where the technology was developed, b) socio-political

[13] There are many different racing series that feed into the 24-Hours of Daytona and Le Mans but for simplicity I gather them under the WEC umbrella as the tracks are central to this writing.
[14] The sponsor-based naming of NASCAR's series had various names as will be shown later.

forces at this level shaped the sport overall, and c) there is little to no published literature about lower levels of M/S.

Since the new millennium, both NASCAR and FIA have expanded their influence to include research and development dedicated to automobility and M/S safety as well as how to mediate the sport's environmental impact (and very recently, more women in M/S).[15] Additionally, there are two terms that require clarification in its use: Grand Prix (GP) and "at full song". Originally, a grand prize was established by the *Automobile Club de France* (ACF) to reward the winning driver of not just an automotive battle, but also a "*bataille industrielle"* (industrial battle) between French, German, Italian, and British car manufacturers.[16] The first GP occurred in 1906 and was worth the modern-day equivalent of $1,000,000 however, ACF did not trademark the term and thus any promoter could, did, (and still does), use the term Grand Prix for a variety of different racing formats and series. The term "at full song" is a common analogy in M/S culture to indicate an engine is at full throttle emitting its highest pitch.

When queried about the origins of auto racing, the seven-time NASCAR champion, Richard Petty has been widely quoted in television interviews repeating what has been attributed to Henry Ford that it began after the manufacture of the second car. While not empirically accurate, neither is it an apocryphal statement as auto racing manifested itself on both sides of the Atlantic starting in the late 19th-century not long after Karl Benz

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[15] Like ACCUS, these are not directly significant to the topic of this dissertation, however these efforts are important because they are emblematic of a sea-change mindset among the leadership for the need to make changes in accordance with the expressed sentiments of journalists and analysts who commented/criticized in print and visual media, as well as spectators who spent billions in various currencies then remarked in letters followed by online and later via social networks.

[16] Philippe Defecheraux, *Watkins Glen, the Street Years 1948-1952* (Deerfield: Dalton Watson Fine Books, 2011). Pp. 10-12

produced his first four-stroke motorcar. Furthermore, it cannot be stated emphatically enough that, contextually speaking, the condition of roadway networks in a young United States were vastly inferior to the centuries-old roads of France – some likened American roads at that time to those in the Ottoman Empire area now known as Turkey which were underdeveloped.

In America, M/S commenced in 1897 with speed runs between wealthy men like Alex Winton who drove from Cleveland to New York City in less than 48 hours.[17] The competitive ambitions of other socialites like William K. Vanderbilt, Jr, Foxhall P. Keane, and Albert C. Bostwick resulted in them acquiring faster, more powerful cars (many from Europe) to outperform one another on road races.[18] Soon the Vanderbilt Cup was established on both private and regular roads near the eponymous creator's estate but it only lasted until 1910.[19] What is interesting to note is that McCarthy cites two documents from that period which helped formulate his assertion that, "People think of Henry Ford as the father of the American automobile, but Ford was actually the midwife to mass-ownership. William K. Vanderbilt, Jr., and his fellow speeding sportsmen fathered the American love of large, fast, powerful cars."[20] In the same manner as will be revealed in later chapters, racing on roads was too dangerous and without mufflers in those decades, the cars were incredibly loud which drew great ire from farmers and villagers stimulating them to throw rocks and sticks at the drivers as they passed by. Road racing in America

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17 James Flink, *The Automobile Age* (Cambridge: The MIT Press, 1992). Page 30

18 Tom McCarthy, *Auto Mania : Cars, Consumers, and the Environment* (New Haven: Yale University Press, 2007). Pages 3-4

19 Brian Ladd, *Autophobia : Love and Hate in the Automotive Age* (Chicago: University of Chicago Press, 2008).

20 McCarthy. Page 4

was doomed to relegation for several decades compared to local oval racing on dirt or board tracks or the initiation of racing at the Indianapolis 500 which is now an iconic race.[21]

In Europe, 1898 marked the beginning of organized auto racing with the *Courses des Capitales* from Paris to Amsterdam which continued until 1903.[22] Over time, races extended to several other European capitals with a starting point of Paris until the race to Madrid, Spain in 1903. With approximately two million spectators lining the roads but with 275 active participants, the race was halted in Bordeaux, France following six spectator fatalities and multiple injuries.[23] Although tragic, this event did not prevent the re-formation of road racing across the Europe in the 1920s as during the Interbellum racing was seen as a cordial event promoting a peaceful Europe.[24] As mentioned previously, it is critical to go into further detail on the different series profiled in this study as while they have basic commonalities, they are vastly different from one another.

Beginning with NASCAR, an overview of what this entity is would be instructive as the details of its creation follow in a later chapter. The cars were initially standard, enclosed family sedans (or saloons in British parlance) and, at the beginning, M/S was **not** endorsed or promoted by the American car manufacturers in Detroit. This was because of the very strong connection with production and transportation of illegal alcohol known as “moonshine” or “shine” for its relatively clear composition.[25] The racing venues were all closed circuits (many still are today) with oval shapes of less than one mile in

[21] While it is iconic and a “legend-maker” for any driver who wins there, it is out of scope for this examination.
[22] Schipper. Pages 47-50
[23] Ibid. Pages 50-52
[24] Ibid. Page 53
[25] Pierce. Chapters 1-3

circumference, except Daytona, and the majority were dirt tracks. This configuration enabled spectators to see the entirety of the spectacle from one seat versus road racing where cars sped by a spectator's single spot many times for a brief flash. Those enthusiast participants were, and to a large part remain, predominantly blue-collar at its core. Eventually, NASCAR expanded to incorporate two to three road racing courses similar to F1 and WEC.

In the early years many of these drivers actually drove their car to the event, raced the car, then drove home in the same car. The premise of NASCAR has always been to pilot a car as fast as physically possible for 400-500 miles (multiple hours without getting out of the car) in competition with about forty other drivers all intent on going faster than anyone else. The fans in the stands cheered for a particular car brand (Buick, Chevrolet, Dodge, or Ford) first and the driver second and since the beginning of car sponsorship in the 1970s, there is empirical evidence (to be discussed later) of fans' loyalty to particular brands if it was festooned across their favorite driver's vehicle with the vehicle's manufacturer being secondary consideration. While Bill France made forays into multi-category races, he quickly settled on uniformity at the top division, subsequently creating other divisions as developmental opportunities for drivers and crew chiefs.

In the 1970s NASCAR's contestants evolved from driver-and-mechanic combination into multi-car teams requiring the addition of specific individuals for each car with particular task assignments such as re-fueling, changing tires, and hoisting the car with a cumbersome jack requiring multiple downward body-weight pumps for the hydraulic pressure to raise car so tires no longer touch the ground for removal/replacement of the wheel and tire combination weighing up to fifty pounds apiece. Refueling cars was about overcoming vacuum pressure so that gasoline in a seventy-pound cannister maneuvered by the largest member of the team would drain into the car's fuel tank. This technique remains in effect today resulting in approximately one-half to a full liter of gasoline spillage per re-fuel attempt of which there are five to six refuel stops per race for each of the 40 cars. When a car came in for a pit stop, they had to learn and rehearse an extreme choreography *ad infinitum* for safety and to eliminate hundredths of a second. Furthermore, NASCAR's top tier cars evolved into rolling data centers but at a very basic degree when compared to F1 and WEC cars. The one factor that differentiates these races from the other top series profiled below is that NASCAR never races in the rain on oval tracks because these are all out speed contests within the boundaries of physical limits thus aerodynamics has a great consequence on handling so slippery surfaces would endanger all drivers.

Understanding F1 requires first realizing that it is a wholesale departure from sedans as well as conventional vehicles and technology. To begin, the cars were/are open-wheel, open cockpit racecars incorporating sophisticated technology, piloted by highly skilled drivers, experiencing severe changes in physical stress on the vehicle and the human body due to severe G-force loads in acceleration, braking, and cornering. F1 races have been time-limited to two hours and are only run on road-courses which are either originally on actual trafficked roads or topographically built in a particular space to incorporate natural landscape undulations and multiple variations of turns and curves. The enthusiast base for F1 was both blue and white collar initially in concert with a specific national interest for cars from a country like Ferrari, Alfa-Romeo, Jaguar, Mercedes, Gordini/Simca, Ligier, etc. To easily identify country affiliation of manufacturers, French cars were painted blue, Germans white/silver, Italians red, and British cars green. The loyalty was less about a specific manufacturer (except Ferrari fans) than about a favorite driver followed then by national pride in the manufacturer that won. What was once a predictable field of colors evolved in the 1960s/1970s into a kaleidoscope of rolling billboards proclaiming the source of commercial funding for team R&D to create those special vehicles.

Like NASCAR, for the fan base who attended these spectacles it was a holiday with massive camping numbers and merry-making from the first day on-site of a festive three-day weekend. As suggested above, the difference for F1 versus NASCAR was the supplemental aspect of supporting national pride in a driver over proclamations supporting any particular car or consumer brand. The F1 supporters were divided into two camps, Ferrari and all others. The Ferrari enthusiasts have always been referred to as the "*tiffosi"* and their legendary support has been a visual sea of red at any race no matter the global venue throughout the history of F1. For all others, the support has primarily been of the driver's home country, not the car he drove, and enthusiasts of F1 have been less beholden to a car's sponsor than NASCAR fans.

Servicing of F1 cars during a race has undergone a myriad of rule changes since 1950. The most important issue has been the matter of refueling. During the initial decades there was no option but to refuel using an unregulated alchemy that the teams concocted to find the ultimate ignition during the race as cars cold not complete of a two-hour race at full song on one tank of fuel.[26] It was not until multiple fiery but non-fatal pit stops that it became imperative to require cars to complete a full race without refueling. The change from refueling pit stops at more than ten seconds decreased noticeably to tires-only pit stops of

[26] On alchemy, see: Peter Wright, *Formula 1 Technology* (Warrendale: Society of Automotive Engineers, 2001). Page 66: "When fuel chemistry was free, combustion problems could be solved by various 'rocket fuel' recipes, brewed by the chemists."

about three seconds today which is a lifetime in F1 terms where hundredths, and later thousands, of a second meant winning or losing. Furthermore, where performance changes were once calculated on paper with slide rules and communicated via message boards held up when drivers passed by, the implementation of sophisticated telemetry in recent years with hundreds of transmitting sensors per car has radically altered how races are managed and regulated. This development has resulted in the acquisition by F1 teams of some of the most sophisticated supercomputers in the world. On a final note, F1 does race in the rain up to a certain level of common sense and safety.

Completing the overview of these three top tier series is a further elaboration of WEC. This type of racing included four to five different vehicle categories, mostly closed cockpit, all competing on the same track at the same time resulting in 50-60 cars causing a crowded racing space. Over the years, the nomenclature of categories has changed so the more important aspect to understand is the fastest level is known as prototype cars which are only slightly less sophisticated with experimental technology than F1 cars and are divided into fully enclosed and open cockpit. Just below that are heavily modified and high-powered Grand Touring (GT) cars like Chevy Corvette, Cadillac, Ferrari, Aston-Martin, and Jaguar followed by modified sporting entries like Porsche, BMW, Audi, Mustang, and Camaro. Unlike the two-hour F1 races, and the NASCAR 400-500 mile events which last about four hours, WEC competitions are a minimum of six hours, sometimes twelve hours, with the most robust venues of Daytona and Le Mans lasting 24 hours of continuous racing. In order to accomplish these feats, every team must have multiple drivers and each is required to have a minimum driving time – this is dependent upon the length of the race. Unlike the other two series, WEC drivers must be alert to the unique feature of other cars that are much slower, even at full song, or much faster than they can go. Enthusiasts of WEC were also fans of F1 and NASCAR as elements of both were part of the endurance race scenario because drivers from other series have often crossed over toe WEC (both for specific races and permanently) bringing their fans interest along as demonstrated on television during in-race crowd interviews.

Like the diverse utility systems Hughes examined, each of the systems to be profiled in this study had their own regional style in their evolution. Thus, it is worth reminding the reader that M/S is a global activity with multiple formats and series in each country beyond the three profiled herein which for most of the period in this study that meant multiple supporting races over a three-day weekend at a single location. Before discussing some of those series, there is an important outlier, the World Rally Championship (WRC). This involved specially modified, powerful (600+ horsepower), four-wheel-drive, compact cars that raced across the entire globe on every inhabited continent on remote trails and some roads, through forests and jungles, over mountains, and in all weather conditions to include snow. While not popular in the United States, global television viewership for the WRC has been on par with F1's average of fifty million per race.[27] Within countries sport and sedan-based series evolved whereby Germany created their *Deutsche Touring Motorrennen* (DTM), Australia formed its powerful Super V-8 niveau, while in the U.S., the Sports Car Club of America (SCCA) raced sedans and the United States Auto Club (USAC) raced a variety of categories with the most well-known being the Midget cars.[28] Enthusiasts each have their own favorite type of these three profiled series however, they

[27] Henry. Page x

[28] Midget cars were/are powerful, open-wheel and open-cage with extreme airfoils on the roof as drivers literally slid sideways in the turns of quarter to half mile dirt tracks. Many NASCAR drivers still race these.

also enjoyed watching any number of other series if they have access to them. For enthusiast participants, any good car race was a good car race, period. This ties back to Hughes' examination of utility systems in that on the one hand there are commonalities which transcended national boundaries.[29] In the case of M/S, these commonalities were engine/drive-train technologies, application of scientific principles, race conditions, regulatory constraints, among others, but they were applied differently depending on the regional style of the venue.

A final element of the sport is important to comprehend and that was the regulatory aspect which had many changes every year that were stringently enforced. There were/are two components that rule books address, the technical rules for the vehicle and the sporting rules for the competition. Technical rules apply to the construction of the car and all of its parts which is applied before the race for scrutineering as well as during the race and post-race inspection while the sporting rules also apply to pre-race scrutineering and during competition. Crafted by large globally-represented committees within FIA, it has always made those regulations public but in an astonishing twist on transparency, NASCAR has never published, and still does not publish, their rule book created by a small committee. It tightly controls its distribution to the teams and a very few media analysts who explain controversies and infractions to enthusiast participants over radio and television. While we cannot see the NASCAR rules, examples from the 2001 F1 technical regulations include:[30]

- Article 4: Weight
  4.1: Minimum Weight
  The weight of the car must not be less than 600 kg.

[29] Hughes. Page 462
[30] Wright. Appendix D – FIA 2001 Technical Regulations.

- Article 7: Oil and Coolant Systems
  7.4: Transversal location of oil system:
    No part of the car containing oil may be more than 700 mm from the longitudinal centre line of the car

- Article 10: Suspension and Steering Systems
  10.3 Suspension members
  10.3.2: No major axis of a cross section of a suspension member may subtend an angle greater than 5° to the reference plane when measured parallel to the centre line of the car.

- Article 14: Safety Equipment
  14.1 Fire extinguishers:
  14.1.1 All cars must be fitted with afire extinguishing system which will discharge into the cockpit and into the engine compartment.

The physical transformation of the space to be discussed here was envisaged with different meanings relative to particular roles of the participant and the locus of that participant. Participant, refers to three groups: active (team owner, engineer, driver, mechanic), operative (sanctioning bodies, track owners, race organizers), and enthusiast (spectator, journalist, analyst, television commentator). For all three participant types within NASCAR, it was a transfiguration from a regional niche of individuals with driving and mechanical skills who worked on, and raced, the cars they drove to the track into a global spectacle that employed thousands and entertained millions. The FIA was much more complex in its role over F1.

From the vantage point of the F1 enthusiasts (and by extension those of WEC), it was a transformation from a daring and dangerous past-time into a more encompassing and shared socio-cultural experience strongly laced with national pride yet centered on technological innovation. For the active participants it was more of a metamorphosis spurred on by a coproduced hegemony in tension with ever-changing regulatory hindrances, artful technological chicanery, and enormous egos. The operative perspective of the FIA was that of a transmogrification due in part to – in the FIA's minds – preposterous demands for implementing costly safety measures, a seemingly absurd affront to their ownership of power and control over M/S, and the unmitigated temerity of wanting to expand beyond European boundaries[31].

Concomitant with this was a postwar awakening of consumers in Europe, and the re-acquainting in the United States, with regard to newly acquired access to greater mobility in conjunction with greater amounts of free time and comparatively greater fiscal comfort. But all was not idyllic as there were still unsettling issues like the forced "population transfer" of those whose homes were unfortunately in the newly established communist territories[32]. Additionally, labor and production were bifurcated matters with strife, strikes, and incompetent management in England and France while West Germany was benefitting from the Marshall Plan[33]. Nonetheless, transportation and road network building was an order of magnitude higher than ever before. People were buying cars and developing interest, as well as technical skills, in customizing their vehicle for better performance or personalization[34]. Many then took these machines, because they had more free time, to see

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31 Michael Adas, *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance* (Ithaca: Cornell University Press, 1989). See also, Bower.

32 Perti Ahonen, *After the Expulsion: West Germany and Eastern Europe 1945-1990* (Oxford: Oxford University Press, 2003).

33 Gordon Wright, *France in Modern Times* (New York: W.W. Norton and Company, 1981 (1974, 1960))., Maurice Larkin, *France since the Popular Front: Government and People 1936-1996* (Oxford: Oxford University Press, 2005 (1997, 1988))., James Laux, *The European Automobile Industry* (New York: Twayne Publishers, 1992)., L. J. K. Setright, *Drive On! A Social History of the Motorcar* (London: Granta Books, 2004)., Roland Stephen, *Vehicle of Influence: Building a European Car Market* (Ann Arbor: The University of Michigan Press, 2000, 2003).

34 Kevin Borg, *Auto Mechanics: Technology and Expertise in Twentieth-Century America* (Baltimore: Johns Hopkins University Press, 2007)., David N. Lucsko, *The Business of Speed: The Hot Rod Industry in America, 1915-1990* (Baltimore: Johns Hopkins University Press, 2008)., David Morris, "Cars with the Boom: Identity and Territory in American Postwar Automobile Sound," *Technology and Culture* 55, no. 2 (2014)., Stefan Krebs, ""Dial Gauge Versus Senses 1-0": German Car Mechanics and the Introductionof

first-hand how the culturally-anointed experts performed their mechanical feats and competed. As they read magazines, saw races in-person and later on television, attended auto shows or meetings, and observed advertisements, as enthusiasm developed for newer or improved automotive technologies.[35]

Unique monikers as identity for locales are culturally important to enthusiasts of sports competition. In the sporting world of "stick and ball" games, special venues are known immediately by either one word or a nickname.[36] For example, in England there is "Wembley" for a variety of games and other events[37] and Wimbledon for tennis, while Spain has Camp Nou for football[38]. Across the Atlantic can be found "the Garden" in New York City (basketball, ice hockey and other events)[39], "the Green Monster" in Boston (baseball)[40], "the Coliseum" in Los Angeles (American football and other events)[41], and finally "The Big House" for American college football at the University of Michigan in Ann Arbor, MI[42].

Within M/S, several iconic venues have specific segments which define the circuits. In no order of significance these are: the "Parabolica" at Monza in Italy[43], the "Corkscrew" at

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New Diagnostics Equipment, 1950-1980," ibid., Christopher Neumaier, "Eco-Friendly Versus Cancer-Causing: Perceptions of Diesel Cars in West Germany and the United States, 1970-1990," ibid.

[35] Leading publications included Car & Driver, Road & Track, and Motor Trend in the U.S., Auto Bild in Germany, L'Auto-Journal in France, and Autosport in England.

[36] This is a common term used to differentiate these types of sporting activities.

[37] Capacity of 90,000 spectators.

[38] Largest stadium in Europe with capacity of 99,354 spectators.

[39] Actual name is Madison Square Garden with capacity of 20,789 spectators.

[40] The Fenway baseball stadium so nick-named for an extraordinarily high left-field wall.

[41] Named for its Roman-style architecture mimicking the Roman Coliseum with capacity of 93,607.

[42] It is the second largest sporting stadium in the world with capacity just under 110,000.

[43] So named for the final massive curve which tightens exponentially the further drivers navigate into it resulting in lateral 5-G force on driver.

Laguna Seca in California[44], the "Mulsanne Straight" at Le Mans in France[45], the "Nordschleife" at the Nürburgring in Germany[46], "Eau Rouge" at Spa in Belgium[47], the "Tunnel" in Monaco[48], and "The Glen" at Watkins Glen[49] in New York state and last but not least "Bristol" for Bristol, Tennessee[50]. The specific facilities I examine are, alphabetically: Daytona (Florida, US), Le Mans (France)[51], Monte Carlo (Monaco), Nürburgring Nordschleife[52] (Germany), Spa-Francorchamps (Belgium), and Watkins Glen (New York, US, hereafter referred to as WGI). Each has a unique relationship with shifting space, wide swings of techno-regulatory pendula, nationalistic pride, and participants. Daytona races began on a combination of beaches and ocean-side streets in the early decades of the 20th century before transferring in 1959 to a purpose-built, high-banked, 2.5-mile oval superspeedway with a road course addition in the center for an overall 3.5-mile circuit. Le Mans began on public roads in 1921 and over time morphed into a purpose-built facility on its northern section but still using public roads -- D139, D140, and D338 -- for the balance and totaling 13.6-km. Monte Carlo remains an annual 3.3-km race through the city center with a few visible modifications since 1929. The very long 22.8-km

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44 One particular segment drops dramatically in elevation while simultaneously having very sharp turns.

45 A 6-km straight where a race-car was clocked by radar at 405 km/h (252 mph) in 1998 and where chicanes have since been added to reduce speeds.

46 Also known as the "Green Hell" and will be further explained below.

47 Twisting uphill segment where lateral G-forces approach 5-G's while simultaneously experiencing vertical force of almost 2-G's in compression at the bottom with near weightlessness at the summit equivalent to a 13-story building.

48 The racecourse proceeds as a curve under a large hotel at the waterfront which greatly effects vision and exiting the tunnel into daylight with a short downhill segment leading into a left-handed chicane where many drivers have miscalculated the intricacy in relation to the speed and the technology.

49 An eponymous section added in 1972 to the original course.

50 Bristol Motor Speedway is one of the shortest NASCAR tracks which is a half-mile bullring style coliseum with steeply banked curves and a capacity of 162,000 spectators. It has been one of the most desired viewing spectacles on the NASCAR calendar. Until very recently, according to numerous racing journalists, the only means to attend in-person was to inherit tickets.

51 The actual name is Circuit de la Sarthe but will be referred to here as Le Mans.

52 As will be described in the chapter, the track in use today has the singular name but is a mere shadow of the original known as Nordschleife which is still used for individual/personal timing runs and manufacturer testing. For this writing I will refer to the original track using both terms.

Nürburgring was built in 1925 combining purpose-built sections with public roads and which has since been physically diminished as well as a minimized status in F1. Spa was originally a 15-km. long racetrack mapped out using public roads in 1925 until eventually becoming smaller and solely purpose-built course. At Watkins Glen, the original 6.5-mile races were run through the village and surrounding countryside 1948-1952, then interim races on nearby farm roads until 1956 when races began at a 2.3- mile (later 3.4-mile) purpose-built facility. There is a prominent interconnectedness with these courses that is essential to consider due to different racing styles and technologies as the series' have vastly different technical and physical vehicular structures and regulations, yet it was common for drivers to challenge their skill sets by driving the varied vehicle types.[53] What is also important to keep in mind as these timelines unfold is to consider the network as the overall global M/S entity and the tracks as the technical systems.

During the period from 1950 to the early 1960s, five of the most prominent inventor/entrepreneurs were Cameron Argetsinger, Bill France, Sr., John Cooper, Colin Chapman, and Bernie Ecclestone. The racing location profiled during this timeframe will be Watkins Glen in the Finger Lakes region of western New York state. The second era, from early 1960s to early 1980s, saw a migration of people and knowledge bases on both sides of the Atlantic. This was also the period in F1 where the center of global M/S technology began transitioning from Italy to the UK and when the co-produced hegemony of F1 flourished in the person of Bernie Ecclestone.[54] A guileful businessman, he was a

[53] Each chapter will specify which series and formats were contested at a particular circuit. Nigel Mansell, *In the Driving Seat: A Guide to the Grand Prix Circuits* (London: Stanley Paul, 1989).
[54] Fernand Braudel, *Afterthoughts on Material Civilization and Capitalism* (Baltimore: Johns Hopkins Press, 1977). I use his concept of societal centers moving as people do.

paradoxical enigma whose methods have been resoundingly vilified, yet he was responsible for not just making people rich and building the F1 brand via television coverage on a global scale. He also was responsible for improving: driver safety, fiscal conditions for non-manufacturer Formula One Constructor's Association (FOCA) teams, and spectator enjoyment of these highly contested events.[55] The tracks profiled in this chapter will be Daytona in Florida and the removal of Germany's Nürburgring from F1 schedules.

The third epoch took place from the early 1980s to the early 2000s with several new circuits added to both F1 and NASCAR schedules. The circuit to be highlighted is the return of Belgium's Spa-Francorchamps after more than a decade of total re-construction in order to meet safety requirements. From the early 2000s through 2010, is a fourth period and where tensions (if not outright hostilities) were extraordinarily high between operatives and actives in F1, to a lesser extent in NASCAR, and even less so in WEC. Two remaining courses, Monaco and Le Mans, will be examined in this chapter. In the years since 2010, several key innovations have been implemented and new events occurred which will be discussed in a Concluding chapter.

This narrative embraces interdisciplinarity as it interconnects a wide swath of existing literature related to racing, automobility, technology and practice, environment/infrastructure, consumption, and transnational studies. With regard to automotive racing, there is a comparative dearth of academic literature as there are only

[55] Known as Formula One Constructors Association (FOCA) these are non-factory-supported car teams. Alan Henry, *The Powerbrokers: The Battle for F1's Billions* (St. Paul: Motorbooks International, 2003)., Ivan Rendall, *The Power Game: The History of Formula 1 and the World Championship* (London: Cassell and Co., 2000).

three monographs on the subject and even then, the topics are tangential. The first one by Bob Post (2003), *High Performance*, extensively explores the straight-line, massively powered drag races which compete over a quarter-mile distance.[56] The second by David Lucsko (2008), *The Business of Speed*, provides an enlightening history of enthusiast participants hot-rodding, DIY after-market performance enhancements to personal vehicles, and the exponential growth of a powerful industry under the umbrella of the Specialty Equipment Manufacturer Association (SEMA), founded in the 1960s[57]. The third is the 2010 contribution by Daniel Pierce, *Real NASCAR: White Lightning, Red Clay, and Big Bill France*, which examines the origins of American speedway racing[58]. There have been a handful of recent socio-cultural and technical Master's theses and PhD dissertations since 2004 about racing plus a growing number of articles on technology and safety in racing with the majority through the Society of Automotive Engineers (SAE) Motorsport Division[59].

What the existing literature does not address is the dynamics between enthusiasts, active, and operative participants. How did enthusiasts become impacted by any particular M/S series? Why did they begin attending racing events to personally experience these competitive genres? What enabled their participation that did not exist prior to 1950? How

56 Robert C. Post, *High Performance : The Culture and Technology of Drag Racing, 1950-2000* (Baltimore: Johns Hopkins University Press, 2001). Power is defined as Horse Power (aka. HP) with current high-level Top Fuel cars running almost 10,000 HP.
57 Lucsko., p. 155
58 Pierce.
59 Sean O'Connor, "An Examination for the Marketing Strategy of the World Rally Championship" (Master's, Dublin Institute of Technology, 2004); Ben Shackleford, "Going National While Staying Southern: Stock Car Racing in America, 1949-1979" (Dissertation, Georgia Institute of Technology, 2004); Carlos Martinez-Vela, "The Duality of Innovation: Implications for the Role of the University in Economic Development" (Dissertation, MIT, 2007); Peter Westin, "A Fly in the Patriot's Wheel: The Intersection of Applied Research, Regenerative Braking, Motorsports, and Industry" (Master's, Georgia Institute of Technology, 2012); Chris Patton, "Development of Vehicle Dynamic Tools for Motorsports" (Dissertation, Oregan State University, 2013).

did this newly discovered participation affect the sport itself over time? How did regulatory changes affect M/S?

Conversely, research into automobility is quite rich. We have been informed by John Rae's 1982 work *The American Automobile Industry*[60], followed by James Flink's 1992 book *The Automobile Age*[61], and James Laux's *The European Automobile Industry* of the same year[62], to LJK Setright's expansive 2004 manuscript *Drive On! A Social History of the Motorcar*[63], and Rudi Volti's *Cars and Culture: The Life Story of a Technology.*[64] From all of these we learn of the various story-lines of how societies made, regulated, and used the car. But why did people in America and Europe start attending racing events *en masse* and relating their attendance to their ownership of a car? Did they develop a bond or relationship with particular car brands, tires, service providers, and if so why?

As it might pertain to technology and practice in M/S, there exists a plethora of material to draw upon but there are a few more salient works that I elevate to greater prominence. In addition to Hughes' *Networks of Power*, there is Adas' *Machines as the Measure of Men* because of its look into the colonial mindset of European power-brokers which helped inform this study regarding the colonial tactics in the early years of the European-based FIA.[65] George Basalla's *Evolution of Technology* and David Edgerton's *The Shock of the Old* for unravelling the complicated history of the evolution of innovations as occurred

60 John Rae, *The American Automobile Industry* (New York: Twayne Publishers, 1984).
61 Flink.
62 Laux.
63 Setright.
64 Rudi Volti, *Cars and Culture: The Life Story of a Technology* (Baltimore, MD: Johns Hopkins University Press, 2006).
65 Adas.

with turbo-diesel engines.[66] A frequent problem in M/S is what Joel Mokyr refers to in *Lever of Riches* as the "Leonardo Problem" where actual technology has not caught up with innovative ideas which was the case for the implementation of regenerative braking[67]. The edited books *The Social Construction of Technology* [68] and *How Users Matter*[69] are seminal with their theoretical exemplars of technology while the volumes on knowledge and use that follow below have a direct connection with application in M/S thus a detailed discussion of how they informed this dissertation.

Knowledge and use in M/S is rife with entanglements. It is on the one hand very private to the entity possessing it as that knowledge could be the source of winning races. On the other hand, it becomes shared over time as people migrated to other teams yet they still possessed that winning knowledge and could use a derivative of it with their new team. Using tools and knowledge of how to make a car circumnavigate a racetrack faster before any other team becomes aware of that technical knowledge is priceless. That was what led teams to championships thus a fundamental element that is another key component to M/S.

With regard to the production of knowledge in M/S, that knowledge existed initially as a sensory-based expertise in how something felt, smelled, sounded, or looked. Harry Collins conducts a deep dive as he proposes three sub-categories of tacit knowledge in *Tacit and Explicit Knowledge* where he addresses exactly those knowledge variables that occur in

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[66] George Basalla, *The Evolution of Technology* (Cambridge: Cambridge University Press, 1988). And David Edgerton, *The Shock of the Old: Technology and Global History since 1900* (Oxford: Oxford University Press, 2007).
[67] Joel Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress* (New York: Oxford University Press, 1990).
[68] Wiebe E. Bijker, Thomas Parker Hughes, and T. J. Pinch, *The Social Construction of Technological Systems : New Directions in the Sociology and History of Technology* (Cambridge, Mass.: MIT Press, 1987).
[69] N. Oudshoorn, Pinch, T., ed. *How Users Matter: The Co-Construction of Users and Technology*. (Cambridge: The MIT Press, 2005).

M/S teams.[70] Walter Vincenti's influential work *What Engineers Know and How They Know It* examines the unique tacit aspects of manufacturing of aircraft with a eye on aerodynamics which directly relates to M/S innovation.[71] Eric von Hippel's *The Sources of Innovation* reminds the reader that innovation can arise from any member of an organization and that experimentation was a key part of M/S development.[72] The notion of discovery in M/S is validated by Polanyi in *Personal Knowledge: Towards a Post-Critical Philosophy* such that sometimes, "Accident usually plays some part in discovery and its part may be predominant.[73]" As to the practice of knowledge production in M/S, in *The Culture of Technology*, Arnold Pacey proffers his "Pacey's triangle" linking cultural, organizational, and technical aspects of technology-practice which ha states is "*the application of scientific and other knowledge to practical tasks by ordered systems that involve people and organizations, living things and machines.*[74]" Andrew Pickering in *The Mangle of Practice*, develops a completely different approach to understanding knowledge (and physical) production with material agency and macro-actors which directly relate to people and their activities in M/S.[75] As it pertains to the migration of knowledge, the late Ann Johnson explains how knowledge flowed during the development of Anti-lock Braking Systems (ABS) in *Hitting the Brakes*[76]. For the diffusion of knowledge (and produced goods) the recognized source of expertise is found in Everett Rogers' *Diffusion*

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[70] Harry Collins, *Tacit and Explicit Knowledge* (Chicago: University of Chicago Press, 2010).

[71] Walter Vincenti, *What Enginers Know and How They Know It: Anaytical Studies from Aeronautical Industry* (Baltimore: Johns Hopkins University Press, 1990, 1993).

[72] Eric von Hippel, *The Sources of Innovation* (New York: Oxford University Press, 1988, 1995).

[73] Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (Chicago: University of Chicago Press, 1958, 1962, 2015). Page 120.

[74] Arnold Pacey, *The Culture of Technology* (Cambridge: MIT Press, 1996). Page 6, italics in original.

[75] Andrew Pickering, *The Mangle of Practice: Time, Agency, & Science* (Chicago: University of Chicago Press, 1995).

[76] Ann Johnson, *Hitting the Brakes: Engineering Design and the Production of Knowledge* (Durham: Duke University Press, 2009).

of Innovations[77]. At this point I must clarify that I believe the term "migration" of knowledge is more illustrative of M/S as compared to the conventional, and all too precise, "knowledge flow". This is because "flow" implies directionality whereas in the racing community, active participants literally migrate from one team to another sometimes returning to any given team a second or even third time. The explication of this topic regarding M/S, as thorough as it is, has been limited to a handful of British academics in management and geographic studies.[78]

A further element to this analysis of the consumption of M/S and automobility is that of changing boundaries plus shifting topography encountered at these venues which draws upon literature about the environment, infrastructure, and consumption. A major point of departure was a tension between advancing automotive technology and the local populace in the way Hughes describes how Bavarians voiced their concern about the impact the *Walchensee* project for electrical distribution would have on the Alpine forests and nature in general.[79] This sentiment also prevailed among many with regard to efforts at building racetracks. Many canonical works view environmental history from the *longue durée* viewpoint, but I will draw from temporally relevant environmental history monographs. In the latter sections of Joachim Radkau's *Nature and Power* illuminates the fractious and

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[77] Everett Rogers, *Diffusion of Innovations*, Fifth ed. (New York: Free Press, Division of Simon & Schuster, Inc., 2003).

[78] Among them are: M. Jenkins, "Technological Dicontinuities and Comparative Advantage: A Historical Perspective on Formula 1 Motor Racing 1950-2006," *Journal of Management Studies* 47, no. 5 (2010); M. Jenkins, Floyd, S., "Trajectories in the Evolution of Technology: A Multi-Level Study of Competition in Formula 1 Racing," *Organization Studies* 22, no. 6 (2001); N. Henry, Pinch, S., Russell, S., "In Pole Position?: Untraded Interdependencies, New Industrial Spaces, and the British Motor Sport Industry," *Area* 28, no. 1 (1996); N. Henry, Pinch, S. , "Spatialising Knowledge: Placing the Knowledge Community of Motor Sport Valley," *Geoforum* 31 (2000); Steven; Henry Pinch, Nick, "Paul Krugman's Geographical Economics, Industrial Clustering and the British Motor Sport Industry," *Regional Studies* 33 (1999); G. Foxall, Johnston, B., "Innovation in Grand Prix Motor Racing: The Evolution of Technology, Organization, and Strategy," *Technovation* 11, no. 7 (1991).

[79] Hughes. Page 324

contentious European efforts during the latter decades of the 20th century at controlling and reducing air pollution which would eventually affect the way FIA approached environmental issues, and Susan Strasser's *Waste and Want* in chapter six addressing the practice of scrapping by enthusiasts which was essential to restoring their cars back to their original condition or customize them[80].

In addition, there are a number of insightful edited compilations starting with William Cronon's *Uncommon Ground* which amplify the conversation about the meaning of nature or whether there should be a meaning assigned to nature at all. These tensions were borne out in building racetracks. With *Environmental Histories of the Cold War* by J.R.McNeill and Corinna Unger, *The Illusory Boundary* by Martin Reuss and Stephen E. Cutcliffe, these all explicate transnational environmental problems. This matter began touching the sphere of M/S and automobility in the final decades of the 20th century. *The World Beyond the Windshield* by Christof Mauch and Thomas Zeller contribute significantly to understanding how roadways in America and Europe were negotiated and constructed in the 1900s[81].

The relationship between consumption and environmental impact is indeed a tangled one as Arnulf Grübler reveals his concept about postwar leisure capital and environmental impact in *Technology and Global Change*. His notion of "time budgets" explains an intricate relationship between technology, having an organized schedule around a standard

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80 JR McNeill, *Something New under the Sun: An Environmental History of the Twentieth-Century World* (New York: W.W. Norton, 2000, 2001). Joachim Radkau, *Nature and Power: A Global History of the Environment* (Cambridge: Cambridge University Press, 2002, 2008); Susan Strasser, *Waste and Want: A Social History of Trash* (New York: Metropolitan Books, 1999).

81 William Cronon, ed. *Uncommon Ground: Rethinking the Human Place in Nature* (New York: W.W. Norton, 1995, 1996); McNeill; M. Reuss, Cutcliffe, S., ed. *The Illusory Boundary* (Charlottesville: University of Virginia Press, 2010); C. Mauch, Zeller, T., ed. *The World Beyond the Windshield: Roads and Landscapes in the United States and Europe* (Athens: Ohio University Press, 2008).

work-week, free time for entertainment and relaxation, and the impact on the environment which particularly relates to all participants of M/S. This relationship is further explored in *Getting and Spending* edited by Susan Strasser, et al. in its multiple chapters about how postwar consumption transformed a population. What was the relationship between participants and M/S regarding the expanding concern over the toll on the environment with respect to the use of the automobile in M/S? When did enthusiast concern drive action upon environmental issues? How?

The last grouping of literature drawn upon for this dissertation I refer to as infrastructure and transnational studies. Beginning with the transnational, the edited works by Mauch and Strasser mentioned above elucidate upon automobility matters on both sides of the Atlantic Ocean. Further transnational literature is found in Manuel Castells' *The Rise of the Network Society* where he informs this narrative regarding transnational networks, "informational global econom[ies] organized around command and control centers" such as those found in M/S.[82] In Scott Pells' *Not Like Us*, he writes about cultural influences from American tourists and military personnel brought changes to young Europeans daily lifestyle choices while their experiences in Europe were brought back to "the States", as it called by those living abroad, and shared.

These are complemented by a number of journal articles on transnational study of which important ones are "<u>Introduction: Have we ever been transnational? Towards a history of science across and beyond borders</u>" by Turchetti, et al., as well as "<u>Toward a Transnational</u>

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[82] Castells. Page 409

History of Technology: Meanings, Promises, and Pitfalls" by Erik van der Vleuten[83]. Deeply integrated into the transnational narrative are the stories of grand infrastructure projects and from the macro level we learn of failed planning in James C. Scott's *Seeing Like A State* which some could link to Nürburgring and Watkins Glen. With specific focus on transportation or automobility and the roadway networks used by M/S participants, there are three noted works: the newest addition to the library in the name of *Europe's Infrastructure Transition* by Per Högselius, et al., Chris Wells' exploration of the American highway system and population shift in *Car Country*, and Frank Schipper's examination of the European road network culminating in the E-road system found in *Driving Europe* [84].

The subject of comparative versus transnational study of history has existed for some time. One group of historians, like Tyrell and Turchetti, consider flows of people and knowledge as the essential element for transnational history.[85] Another segment such as Pestre, Connelly, and Beckert, resist spending time on the specific classification or theorization of transnational history.[86] Still others, with whom I am in agreement, refer to transnational history as the examination of, as Beckert states, of the "range of connections that transcend political bounded territories", and Huntington adds about transnational operations, "significant centrally-directed operations in territories of two or more nation-states".[87]

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[83] S. Turchetti, Herran, N., Boudia, S., "Introduction: Have We Ever Been Transnational? Towards a History of Science across and Beyond Borders," *British Society for the History of Science* 45, no. 3 (2012); Erik van der Vleuten, "Toward a Transnational History of Technology: Meanings, Promises, and Pitfalls," *Technology and Culture* 49, no. 4 (2008).

[84] P. Högselius, Kaijser, A., van der Vleuten, *Europe's Infrastructure Transition: Economy, War, Nature*, ed. J. Schot, Scranton, P., Making Europe: Technology and Transformations, 1850-2000 (London: Palgrave MacMillan, 2016); Wells; Schipper.

[85] Turchetti. Page 321

[86] Beckert Bayly, et al., "Ahr Conversation: On Transnational History," *American Historical Review* December (2006). Turchetti. Page 336

[87] Beckert in Bayly. Page 1446; van der Vleuten. Page 979

Furthermore, Hughes adds, “The cultural forces influencing the systems stemmed from the societies within which the systems grew” and that “the cultural forces varied from society to society, but there were also forces that transcended local and regional characteristics.”[88] That transcendent force in this account was the physical participation in M/S and its extensions regardless of the series and how innovations in technology and materials transferred across borders. American open-wheel race-cars had been manufactured in the United States but the 1970s saw this migrate to the MSV in England as it is today. The driver safety device known as HANS began in America and spread across the globe. This narration is not comparing either side of the Atlantic Ocean with regard to M/S thus it is not a comparative history because neither continent is portrayed as superior or inferior. In the vein of Turchetti, it is a hybridization of temporally parallel occurrences that may seem comparative but are simply acknowledgements of what actually took place.[89]

What has yet to be examined therefore, is an *in tempus,* parallel, transnational exploration of how ordinary people made/used the car, at the same time as specific talented active participants modified cars to an extreme level for intense competition, while developing a unique socio-cultural framework for a community of supporters and enthusiasts. Within each chapter will be a number of interdependencies as well as specific “turning points” of M/S history in the same vein as Frank Ükötter compiled in the edited book *The Turning Points of Environmental History*.[90] By approaching this topic in the way I have, it adds to the current literature of several fields by weaving together connections across automotive

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[88] Hughes. Page 462
[89] Turchetti. Page 330
[90] Frank Uekötter, ed. *The Turning Points of Environmental History* (Pittsburgh: University of Pittsburgh Press, 2010).

history, business history, environmental history, European history, history of technology, sport history, and other fields/disciplines. Multiple authors of works foundational to this study and elsewhere in academic literature have lamented the lack of interdisciplinary research while others disapprove of interdisciplinarity as a dilution of any given field. My approach is firmly in support of interdisciplinary research for the very reason that it opens intellectual doors and new pathways.

CHAPTER II : INVENTION AND DEVELOPMENT OF A SYSTEM: 1950 TO THE EARLY 1960S

The flow of this chapter begins with situating the larger view of what occurred in the decade following the postwar years as the sentiment of the time impacted the contextualized understanding of automobility and M/S. In this chapter the "Big Picture" has a greater role than M/S in that it established the roots of how enthusiast, active, and administrative participants experienced their eventual community whether that was in Europe or America. The variations in undercurrents of government intervention, migration/ people movement, work/production, and activities of daily life did indeed have a bearing on how enthusiasts chose to participate in M/S.

The next section absorbs what it meant being in a larger consumer economy for Europeans that was new to, and different from, walking to the village *Boulanger* (bakery-French) or *Metzgerai* (butcher shop-German). That required learning a new mindset of the behavioral change to becoming a responsible consumer which, in the following decades, would become essential as manufacturers and corporations would advertise M/S events at football matches as well as at racing venues to a growing M/S following, buying M/S related merchandise in addition to cars, tires, windshield wipers, etc. Existing little during the Interbellum, the notion of consumption can only be bridged by understanding this decade's transformative actions.

This is followed by the identification of particular inventor/entrepreneurs who affected M/S in major ways. Finally the examination of WGI reveals the transformative process of the making of a technical system from an aggregate of ideas.

The years following World War II bore witness to a bifurcated view of resurrection from the destruction and human calamity that occurred during those war years. On the one hand, the phenomenon referred to by some as American Exceptionalism epitomized how the spatially distant events that took place in Europe and Asia minimally impacted postwar life in North America. On the other, Europe and Asia were struggling to recover from the ravages of war that enveloped their space. While there was an expression of fiscal American governmental assistance toward Japan, the support for European recovery via the Marshall Plan was far greater. A decade after the Marshall Plan began, the Treaty of Rome was signed in 1957 which created the administrative space to form the European Economic Community (EEC) which, at its core "stood the basic objective of a customs union, to be implemented through elimination of internal tariffs in predetermined stages."[91] But it would take into the 1960s to implement the treaty and the bifurcation was not just at the supranational level. American television and music from the 1950s depicted an atmosphere that it was a simple and friendly era. Reality was far more challenging, especially in the countries that manufactured automobiles as these macro scenarios would have a profound impact on M/S and automobility.

[91] Andrew Moravcsik, *The Choice for Europe: Social Purpose & State Power from Messina to Maastricht* (London: Routledge, 1998). Page 146

2.1 COUNTRIES, CARS, AND LABOR

From a socio-political point of view, beginning in Europe, the Marshall Plan had been implemented since 1947 with billions of American dollars infusing economic growth as well as seeding various scientific partnerships and cooperative overtures. Concomitant with this was acceptance of the Marshall Plan by Europeans, with trepidation of, "…its broader geopolitical and ideological objectives and in return maintained a measure of control over how it was put in place and adapted it to local circumstances."[92] That a perceived conquering power would fund their re-growth as nation states, with overall decision-making left in their hands, was anathema to their cognitive process following centuries of strife when victorious kingdoms or empires exacted remuneration. As it relates to Europe, Gillingham enumerates, "The economic *Pax Americana* was not…a rigid structure…but rather resembled a nascent *Pax Universalia* of shared authority and responsibility that would grow, over time, out of deep commitment to common principle."[93] That stated, France was reeling from an exceptionally fractious episode known as the Fourth Republic that extended into the late 1950s. As Pells writes, "The French, in particular, were skeptical about philanthropic endeavors of any sort,"[94] plus Krige explains, "the French National Assembly, in signing the European Recovery Plan [ERP], essentially admitted, '…that France was no longer a major power…"[95] Pells further elucidates that, "…middle and upper classes of Western Europe…felt 'humiliated and indignant at the

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[92] Krige. Page 27
[93] John Gillingham, *European Integration 1950 - 2003: Superstate or New Market Economy?* (New York: Cambridge University Press, 2003, 2007). Page 37
[94] Pells. Page 56
[95] Krige. Page 25

thought they may now be reduced to accepting American charity'"[96] This created the semblance of a power vacuum on the European continent and an opening for both sides of the Cold War – the Unites States and Russia. However in the broader context of postwar policies these would shoulder a heavy load on the profusion of opportunities with which both M/S and automobility would proliferate.

From a political standpoint, "it was a period of disintegration"[97] or as Gordon Wright posed the scenario as, "Indeed, until at least the end of the Third Republic, most Frenchmen would have felt more at home in the nineteenth century and did their best to preserve its essential traits."[98] From an economic perspective, daily life was improving for the average family and worker because there were jobs available in factories which meant stability for the first time in decades. So, on balance, the bifurcation was not just because of the Atlantic Ocean, the schism also existed intra-nationally between average person/family finally experiencing a semblance of stability and not too concerned about where or how it originated versus the indignant elite.

In Germany, the balance of the 1940s decade was miserable for the average person and family with rubbled cities, destroyed infrastructure, food shortages and so on. However, the 1950s saw greater improvement with financial backing and administrative support from the US government who saw a weak western Germany as a danger. But for German carmakers, the situation was dependent upon where they were located. Audi and Mercedes-Benz were safe in Stuttgart, "not far from the Rhine", while BMW and Auto-Union were

[96] Pells. Ibid, quoting European-born American André Visson.
[97] Larkin. Page 151
[98] Wright. Page 450

negatively impacted due to having facilities behind what would become the Iron Curtain.[99] At the same time there was relatively little labor strife in Germany because, as Abelshauser puts it, “in Germany the enterprise has historically been regarded as a community,”[100] A major factor here was the 1951 Co-Determination Law (*Mitbestimmung)* that required employee representative participation on supervisory boards of large firms, “a practice that was later extended to other sectors and smaller businesses.”[101]

As a part of the immediate post-war information gathering missions by American Department of Commerce, several excursions took place to investigate various tire factories of the German Continental Tire company and their research into Buna-S manufactured rubber versus natural rubber tires. Among the findings at the Hannover Plant were two interesting notations, one of them about a piece of equipment that was not destroyed during the bombing of March 25, 1944 at the Vahrenwaldstraβe facility, “Testing wheels in the well-equipped tire testing laboratory were of U.S. Bureau of Standards design, one specially equipped for testing at high temperature.”[102] The other was about test data regarding high speed and high heat tests for tires.[103] The question which arose here stems from the highly successful German Interbellum auto racing teams of Auto-Union and Mercedes-Benz in relation to the possibility that this location could have been a testing

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[99] Defecheraux. Page 57

[100] Werner Abelshauser, "Two Kinds of Fordism: On the Differing Roles of the Industry in the Development of the Two German States," in *Fordism Transformed: The Development of Production Methods in the Automobile Industry*, ed. H. Shiomi, Wada, K. (Oxford: Oxford University Press, 1995). Page 286

[101] Pells. Page 266

[102] Russel Hopkinson, "Continental Gummiwerke A.G., Hannover," ed. Department of Commerce (Washington DC: U.S. Publication Board, 1945). Page 10 – Chemical Heritage Foundation, Beckman Center, Philadelphia, PA

[103] Ibid. Pages 115-116

facility for the German racing teams. It is not possible to definitively answer this query as any known paper records were destroyed in the bombings and subsequent postwar looting. However, at that time only motorsports had any scenario of sustained high-speed and high-temperature for tires. It was two years after my Chemical Heritage Foundation Fellowship that I was made aware of a British MI-6 document which specifically discussed extensive R&D as well as testing of racing tires at Continental's Hannover tire plant for proposed land-speed record attempt at (drum) equivalent speeds of 270 miles per hour (450 kmh) and whirling speeds over 400 mph (650 kmh) as well as test temperatures up to 85 Celsius.[104] The combination of these sources leads one to the conclusion that indeed, there was a process in place to enhance the capabilities of German M/S.

In Italy, things were remarkably poor in every sense of the word, especially in the south, a.k.a. Mezzagiorno, where the matter became known as the "Southern Question".[105] Becoming the current nation-state in 1946, it was a country that was attitudinally regional in culture and language. In the north where heavy-industry manufacturing like cars was a major source of employment and where German occupation took place in the latter years of the war, trade unions were deeply ingrained into the very fabric of existence while in the south there was no such emphasis but only profound impoverishment. Of equal import, the Italian Communist movement was exceptionally strong and combative resulting in numerous strikes as most skilled workers were militant socialist or Communist in ideology. The issue of spreading communism was such a troubling matter in late 1940s that even the

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[104] Cameron Earl, "Investigation into the Development of German Grand Prix Racing Cars between 1934 and 1939 (Including a Description of the Mercedes World's Land Speed Record Contender)," ed. British Intelligence Objectives Sub-Committee (London: H.M. Stationery Office, 1947). Section VII, pp. 71-73, IMRRC, Watkins Glen, NY.

[105] Judt. Page 257

Vatican got involved "in mobilizing the people against Communism" having a more important role than the United States.[106] The then state-owned car manufacturer known as FIAT (Fabbrica Italiana Automobili Turino) fired over 2,000 people on political grounds in the early 1950s.[107] It would take decades to settle into a sense of comparative stability.

In the United Kingdom, life was not easy either with continued rationing and increased taxation as major cities, especially London, were clearing the rubble from V1 and V2 rocket impacts from the last gasp efforts by Adolf Hitler. With regard to car manufacturers, the country was besotted by problems like deeply entrenched labor divisiveness and poor management. While industry leaders in the United States and Germany grasped the significance of professionally trained and educated managers, the UK did not until the latter decades of the 20th century.[108] Furthermore, James Laux shares that, "There was little product planning and market analysis, and no effort to hire clever young people from the universities to strengthen these areas."[109]

In the United States, normalization of postwar life was taking place in, what most would acknowledge, was a more civilized manner as there were none of the physical damages to infrastructures or manufacturing facilities. Until the Korean War put a short pause on full recuperation. As they had done a decade earlier, servicemen (primarily men) came home

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[106] Krige. Page 25 and footnote 29 (p. 277)

[107] Stefano Musso, "Production Methods and Industrial Relations at Fiat (1930-90)," in *Fordism Transformed: The Development of Production Methods in the Automobile Industry*, ed. H. Shiomi, Wada, K. (Oxford: Oxford University Press, 1995). Page 258

[108] Stephen. Page 55. See also, Alfred D. Chandler, *The Visible Hand : The Managerial Revolution in American Business* (Cambridge, Mass.: Belknap Press, 1977). Pages 464-468 as well as David C. Mowery, Rosenberg, Nathan, *Technology and the Pursuit of Economic Growth* (Cambridge: Cambridge University Press, 1989, 1991, 1995).

[109] Laux. Page 178

and wanted bigger, faster, and more powerful cars partly because after years of war, their appetite for calculated risk had become elevated which will be discussed further below. There were also autobody and auto mechanics classes to professionalize the knowledge they had gained during the war.[110] Those who came home to manufacturing jobs also, because of higher prices, wanted "wages raised…to compensate for the loss of the overtime pay of the war years."[111] As a consequence, it took until the mid-1950s for both sides to reach an agreement suitable for ratification. In 1970, United Auto Workers President Leonard Woodcock would refer back to this timeframe regarding the postwar UAW/Manufacturer relationship as "a civilized relationship."[112] In all five nations, the major labor concern was a twin hydra-headed threat of de-skilling/automation and changes in status quo in the labor force.[113]

2.2 WAVES OF HUMANITY

Expanding to a broader contextual view, there were three major diasporic groups, two in Europe and one in America. But in order make sense of how and why these major migrations occurred, it is necessary to understand the planning for new transportation infrastructures. This eventually led to armies of construction equipment moving the terrain on massive scales on both sides of the Atlantic for both new living spaces and roadways.[114]

[110] This was highlighted in a paper "Writing the History of Engineering Technology Education at the Oregon Institute of Technology" delivered by Mark Clark (Oregon Institute of Technology) at the annual 2017 SHOT Conference. See also, Krebs.
[111] Rae. Page 106
[112] Flink. Page 280
[113] David Noble, *Forces of Production: A Social History of Industrial Automation* (New York: Alfred A. Knopf, 1984). Particularly chapter 11 regarding *in tempus* attitudes and reactions.
[114] On the environmental impact of expansion of American suburbia see, Adam Ward Rome, *The Bulldozer in the Countryside : Suburban Sprawl and the Rise of American Environmentalism*, Studies in Environment and History (Cambridge ; New York: Cambridge University Press, 2001).

To understand influencers of these roadway networks it useful to look back to the middle of the 19th century and the work of Frederick Law Olmsted. In designing his projects, “he was intent on achieving a popular understanding of significance of natural forms.”[115] The transitional avenues that enabled park-goers to move around and enjoy different areas of parks he designed were part of a holistic landscape with “the term ‘park-way’ to describe the attractive approaches they designed for Brooklyn’s Prospect Park in 1868.”[116]

By the early decades of the 20th century parkways evolved as intentionally designed primary roadways restricted to cars only to the exclusion of two-wheeled conveyances, trucks, etc. with curvilinear controlled access/egress branches. In the early 1930s, both Italian and Nazi German roadway planners visited the United States and were influenced by these parkways in designing their *Autostrada* and *Reichsautobahnen* (hereafter RAB). Following World War II, General of the Army, and later President, Dwight Eisenhower among others were influenced by those transportation networks in developing the American highway system culminating in the 1956 Federal-Aid Highway Act also known as National Interstate and Defense Highways Act (Public Law 84-627). While “[t]raffic engineering was an American road-building paradigm”[117] borrowed by the Europeans in the 1930s, it was in the early 1950s that the E-road network had an established numbering system in accordance with the first annex to the 1950 Declaration on the Construction of Main International Traffic Arteries by the Working Party on Highways for the Economic

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[115] Albert Fein, *Frederick Law Olmsted and the American Environmental Tradition* (New York: George Braziller, 1972). Page 5

[116] Timothy Davis, "The Rise and Decline of the American Parkway," in *The World Beyond the Windshield: Roads and Landscapes in the United States and Europe*
ed. C. Mauch, Zeller, T. (Athens: Ohio University Press, 2008). Page 37

[117] Schipper. Page 189

Commission for Europe (ECE)[118] which was even further inspired by the American approach.[119]

The first tranche of the migratory swell was in Europe and the result of either repatriation or as refugee status and occurred years before E-roads. Responsibility for this endeavor fell upon the United Nations Relocation and Rehabilitation Administration (UNRRA) founded proactively in 1943 in preparation for postwar resettlement. Toward the end of 1945 they managed approximately 260 camps in Western Europe (227 in West Germany alone) vaulting to over 760 camps only 18 months later.[120] However, it was a chaotic and sometimes obfuscated scenario that impacted an international population in the realm of fifteen million human beings.[121] One factor is explicated by Ahonen, "Angered by the brutal Nazi rule in their countries and the perceived 'fifth column' treachery of their interior German minorities, exiled Polish and Czech statesman had been advocating large-scale expulsions of the Germans throughout the war years."[122] Another factor was the millions of people who had no passport ***and*** were no longer a citizen anywhere because they came from a former country and/or region, or empire, that no longer existed in the bounded configuration of the postwar. Furthermore, Allied countries tried to determine what categorizes "displaced" versus "refugee", with respect to whether "they were nationals of a wartime ally…or a former enemy state"[123]

118 Ibid. Page 193
119 Gijs Mom, "Roads without Rails: European Highway-Network Building and the Desire for Long-Range Motorized Mobility," *Technology and Culture* 46, no. 4 (2005). Page 764
120 Judt. Pages 28-29
121 Ahonen. Page 1; Judt. Page 29
122 Ahonen. Page 16
123 Judt. Page 29

The second tranche remains in Europe and revolved around the intense and insatiable need for labor supply in Western Europe and most of this was via trains. This migration was sorted into three prongs: rural denizens shifting from agricultural spaces into regions with factories for steady work; the more predominant intra-European transfer of populace from which the primary emigration source was southern Europe – and the creation of a new term in Germany known as *Gastarbeiter* (Guestworker); "temporary workers" and immigrants from regions colonized by European states of which some became new nation states.[124] It cannot be overstated how important this tranche of immigrants was to the foundation of what was called the *Wirtschaftswunder* in Germany and the *Trente Glorieuses* in France with one common upshot was the growth of non-Germanic restaurants. But more to the point, many of these non-western Europeans became employed in manufacturing which to several extents were indeed connected to the fabrication of automobiles and their ancillary components.

Lastly, in America, an entire generation blossomed with new disposable income as well as home lending insured by the Federal Housing Administration (FHA) plus the newly created Veteran's Administration (VA) guarantee coupled with approximately 16-million returning servicemen.[125] This supportive structure helped make possible an environment of changing land-use policies, according to Wells, enabling an exponentially growing suburbia with the most well-known being the community on Long Island, NY named Levittown.[126] With regard to overall housing starts, Rome informs, "The final tally for 1950

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[124] ibid.Pages 333-336. See also, Eric Wolf, *Europe and the People without History* (Berkeley, Los Angeles: University of California Press, 1982, 2010). Page 383

[125] Wells. Page 257. The overwhelming majority of participants were male but there many women veterans who took part in the benefit.

[126] Rome. Chapter 1.

was even higher – over 1.9 million, more than twice the pre-1945 record."[127] Each of these tranches comprised multiple millions of human beings per segment resulting in the largest intentional flow of civilization in history.[128] While some of the movement was simply to return home, a major segment comprised people who were moving to a perceived better life than they had before the war with jobs and predictable wages.

2.3 LEARNING TO CONSUME

The transition to becoming a consumer society did not simply occur over a short period of time in the Unites States during the first half of the 20th-century but by the late 1930s consumption was equated with citizenship.[129] As people had more time and disposable income in the postwar economies, Americans easily returned to the consumptive normalcy, however in Europe this required people to learn new skills and methods.[130] Consumerism meant changing long-standing processes, methods, techniques, and behavior such as a change from daily purchased fresh food to processed food in cans and boxes to simplify meal preparation as well as incorporating new small appliances to assist with daily chores.[131] However, Ivan Paris informs on the contrarian Italian appliance industry by

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[127] ibid. Page 16

[128] Hobsbawm. Page 51

[129] Charles McGovern, "Consumption and Citizenship in the United States, 1900 - 1940," in *Getting and Spending: European and American Consumer Societies in the Twentieth Century*, ed. S. Strasser, McGovern, C., Judt, M. (Cambridge: Cambridge University Press, 1998). Chapter 2

[130] Michael Wildt, "Changes in Consumption as Social Practice in West Germany During the 1950s," ibid., ed. S. Strasser, Judt, M. Page 301

[131] See Ruth Schwartz Cowan, *More Work for Mother : The Ironies of Household Technology from the Open Hearth to the Microwave* (New York: Basic Books, 1983).; Ruth Oldenziel, "Exporting the American Cold War Kitchen: Challenging Americanization, Technological Transfer, and Domestication," in *Cold War Kitchen: Americanization, Technology, and European Users*, ed. R. Oldenziel, Zachman, K., Inside Technology (Cambridge: MIT Press, 2009).; and Victoria De Grazia, "Changing Consumption Regimes in Europe, 1930-1970: Comparative Perspectives on the Distribution Problem," in *Getting and Spending:*

revealing how they succeeded in attenuating the potent American and German white-goods industry to more adequately meet the needs of smaller Italian kitchens, while accommodating traditional purchasing behaviors, and laundry patterns with domestically manufactured machines.[132] A similar sentiment applied to automobiles.

Beginning with France and in keeping with one of the Fordist concepts that employees should be able to purchase the product they make, "in the mid-50s, Renault's own wage workers began to buy cars in significant numbers."[133] This replicated, to an extent, the feature of Henry Ford's employee's opportunity upon implementation of the $5-day wage system.[134] That stated, the automotive technologies were quite disparate on either side of the Atlantic. In Europe, the "people's" cars following in the footsteps of Henry Ford's Model-T (inexpensive, reliable, and easy to maintain) were the British Mini-Cooper, the German Volkswagen, the French "Deux Chevaux" (2CV), and the Italian Cinquecento (500).[135] Of these, the most interesting development story resides with the 2CV. In early 1936, Pierre Boulanger, the *de facto* head of the French automotive conglomerate Citroën became interested in simple cars for average people having these technical specifications: "carry two farmers and 50 kg. of potatoes at 60 km/h and would sell for the price of a motorcycle"[136] This took his engineers almost four years to develop but World War II

European and American Consumer Societies in the Twentieth Century, ed. S. Strasser, Judt, M. (Cambridge: Cambridge Univerity Press, 1998).

[132] Ivan Paris, "Domestic Appliances and Industrial Design: The Italian White-Goods Industry During the 1950s and 1960s," *Technology and Culture* 57, no. 3 (2016).

[133] Laux. Page 193; and Judt. Page 337

[134] David A. Hounshell, *From the American System to Mass Production, 1800-1932 : The Development of Manufacturing Technology in the United States,* Studies in Industry and Society (Baltimore: Johns Hopkins University Press, 1984). See chapter 6.

[135] Deyan Sudjic, ed. *Fifty Cars That Changed the World* (London: Conran Octopus, 2009). All five are among the top 50 that changed the world according to the Design Museum.

[136] Laux. Page 124

intervened and while there are several notables about the 2CV to enumerate upon, I will focus on one because of its peculiarity. It was said that during the 1950s, Citroën would have given one million French Francs to anyone who, under normal driving conditions, rolled/flipped a 2CV due to its technologically advanced front-wheel assembly design which tilted the front wheels in the direction of the turn.[137] Of even further interest is one of the most technologically advanced cars produced of its time in the form of the Citroen DS in 1955 which was a luxury car and was not a small car. A remarkably forward-thinking vehicle, it was a "thinking man's car, far and away the most modern car in the world,"[138] This passenger car had: high-pressure hydraulics, self-levelling suspension, front disc brakes, load-sensitive lock inhibition for rear brakes, detachable roof, translucent resin-bonded fiberglass, front-wheel drive stability, and a drag-coefficient rivalling that of the slippery little Porsche coupe."[139] The predominant reason for European manufacturers to develop smaller cars was associated with taxation rates based on engine volume and horse-power (HP), i.e. lower HP equated to lower tax rates. To be clear, as will be shown later in this text, Tony Judt offers a succinct commentary, "The greatest single measure of European prosperity was the revolution wrought by the family car."[140] In Postwar Europe car design for the masses was less about impressive stylistic creativity than it was about practical transportation solutions for a variety of household sizes.

American consumers, however, were not hamstrung by this taxation issue and there was a very well-known television commercial exhorting travel with the singing tag-line "See the

[137] This is an anecdotal insertion from my father who lived in France during the mid-to-late 1950s. It does plant a seed for future intellectual exploration.
[138] Setright. Page 100
[139] ibid. Pages 100-101
[140] Judt. Page 339

U.S.A. in your Chevrolet". As automotive designer C. Edson Armi stated about the American populace, "They had saved, they wanted to buy, and they wished to express their individuality through cars, clothes, and other commercially available designs."[141] In what is a seemingly popular deterministic view, technology and, more directly, space technology with respect to automotive design was becoming the mainstay. Aerodynamic inspirations were replete with "pointed noses, long sweeping pontoon fenders, curved windshields…"[142] Contrarily, the eminent designer Raymond Loewy was quoted in the 1942 magazine *Art & Industry* article <u>Design of the Postwar Motor Car</u> that light materials would better suit new cars and that "eliminating projecting hardware" would reduce wind noise and increase safety.[143] Yet, aerodynamics in design was not new as he incorporated this notion in his technically advanced mid-1930s Chrysler Airflow and Huppmobile which, like the similarly progressive Ford Edsel in the mid-1950s, were not embraced by the buying public. Though, in 1953 Loewy did earn automobile success at the Studebaker Corporation and its Starliner Coupe with a contrarian approach for minimal chrome which had become *de riguer* in that decade.[144] Raymond Loewy was a man who, since the 1930s, had established himself as a master designer of the era and across all genres. In a lengthy article published by the Sports Car Club of America (SCCA) in March/April 1955 against the wanton "chromefication" by Detroit manufacturers, he wrote, after a quarter century of industrial design success, "For 126 American corporations – including one automobile

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[141] C. Edson Armi, *The Art of American Car Design : The Profession and Personalities : "Not Simple Like Simon"* (University Park: Pennsylvania State University Press, 1988). Page 49

[142] Flink. Page 286

[143] "Design of the Post-war Motor Car: as seen by Raymond Loewy" in *Art and Industry* (Nov. 1942); Box 23, Folder: Automobiles; Raymond Loewy Archive (Accession 2251); Hagley Museum & Library, DE 19807

[144] Paul Jodard, *Raymond Loewy*, ed. Martin Pawley, Design Heroes (New York: Taplinger Publishing Co. Inc., 1992). 89

company – we have proved time and time again that good taste is salable." Followed by, "I don't think the automotive industry, in general, is showing that kind of faith in good taste today."[145]

Yet, unlike the European car design industry, there was an intense dialectic taking place in American car design industry whereby one arm held the belief that, as Armi quotes a *Life* magazine piece from fall 1946 "After five lean war years the tradition of high fashion was back…The ending of the war…signaled the end of the era of mild practicality"[146] which Detroit readily re-affirmed. The other arm, trumpeted by Loewy, campaigned for smaller, stylish, and better performing cars, writ large: European sports cars. In the same SCCA article above, he commented that designers of the day were briefed to, "give the public what it wants [which was] translated into the flashy, the gadgety, the spectacular." and, "the appetite for this bad diet of bulk and weight and flash is habit forming." [147] This was supplemented by multiple printed attacks on excessive chrome during 1958 and 1959 including: Playboy, Miami News, Worcester Telegram.[148] Almost as if to plant the guidon for this attack, he designed a sleek, curvaceous exterior to attach onto a BMW chassis in 1957. The result was profiled and lauded in three countries to include a special cover story in the American journal Mechanix Illustrated about its construction at a French farm.[149]

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145 "The Future of Automobile Bodies" in Sports Car (March/April 1955); Scrapbook Volume 19; Raymond Loewy Archive (Accession 2251), Hagley Museum and Library, Wilmington, DE 19807. 18

146 Armi. 51

147 "The Future of Automobile Bodies", Page 17

148 Scrapbook Volume 19; Raymond Loewy Archive (Accession 2251), Hagley Museum and Library, Wilmington, DE 19807.

149 "Der Mann, der auch Autos anzieht" in *Quick* (München), July 1957; "Carroserie spéciales" in *Autocar et Grands Routiers,* October 1957; "Raymond Loewy Builds a Car" in *Mechanix Illustrated,* November 1957; Scrapbook 19 Scrapbook Volume 19; Raymond Loewy Archive (Accession 2251), Hagley Museum and Library, Wilmington, DE 19807.

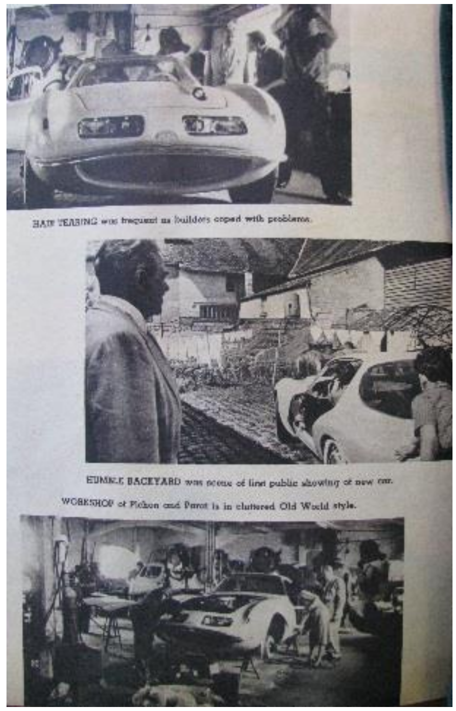

Fig. 2-1: Detailed images of French article on modified BMW. Courtesy of the Hagley Museum and Library

Nonetheless, Detroit's relentless size and pressure pushed the auto market to a perceived 'technical fix' that "added items like automatic transmission, power brakes, power steering, and air conditioning that were considered extras at first but by late 1950s were becoming standard. equipment."[150] American drivers got their "fix" both habit-based and technological – for the time being.

2.4 INVENTORS/ENTREPRENEURS

This section will introduce the innovators who had a unique combination of vision, will, and ability, to be introduced alphabetically beginning with Cameron Argetsinger. Born in

150 Rae. Page 110. On 'technical fix', see Pacey. Page 7, "an attempt to solve a problem by technique alone."

Youngstown, Ohio in 1921, he would become a second-generation lawyer with family connections near the Village of Watkins Glen thus spending summers in the area. He developed his father's passion for fast cars to such an extent that while he was at Cornell Law School (about 30-45 minutes from Watkins Glen) his vision began of a European-style road race known at the time as Grand Prix or, GP. He travelled many area roads around Watkins Glen to determine a course, then was able to convince local officials and leaders of the economic benefit to host an international racing spectacle. This implementation set the foundation for continued surge of racing enthusiasm and participation on many levels throughout the United States. Manuel Castells provides that, "the changing dynamics of networks, and of each network, explains the connection to certain places rather than the places explaining the evolution of the networks."[151] Watkins Glen International would became a major node of the continuously changing global network that was F1 connecting its "Big Bend" with Monza's Parabolica.

The next key individual within motorsports was John Cooper and his radical change in the early 1950s to configuring race-cars by placing the engine behind the driver for a mid-chassis position. Like many examples in Basalla's *Evolution of Technology*, Ferdinand Porsche, before he had his own company, had actually attempted this same concept in 1923 with the Benz RH *Tropfenwagen* but could not be made to work.[152] An RAF instrument maker in WW II, Cooper and his father cobbled together components from a variety of scrap cars resulting in their nicknames "cunning blacksmiths".[153] Dominance in F1 during this era was situated with factory teams like Italy's Alfa-Romeo, followed by Mercedes-

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[151] Castells. Page xxxv.
[152] Basalla. See also, Mokyr. The "Leonardo Problem" is relevant here.
[153] Jenkins. Page 889

Benz in the mid-50s, and Ferrari in the latter portion of the decade. For Enzo Ferrari, the eponymous founder of the car company, it was stylistically anathema to “take up the bug-like rear-engined Cooper style”[154] and because, in his mind, “the ox pulls the cart.”[155] What must be made abundantly clear at this juncture is that, while Cooper’s re-configuration created a major “reverse-salient” for Ferrari, there have been more than 120 F1 teams since its inception in 1950, yet only Ferrari has raced in every year to include the current 2019 season.[156] Cooper’s mid-engine design progressed over the course the 1950s decade with its first F1 series win in 1958 and continued success well into the period of the next chapter.

The next innovator to radically change motorsports was Colin Chapman. An engineer who studied structural engineering at Union College of London also served briefly as a postwar RAF pilot, Chapman began a mathematical-based engineer’s approach to making cars go faster. As Karl Ludvigsen explains, “The application of science to structures began in 1953”[157] which led to space-frame chassis inspired by a variety of precursors using multi-tube structures such as the 1947 Cisitalia Type 360 designed by Porsche engineers and the 1951 Jaguar XK120C. The significance here is that space-frame chassis makes for a lighter car yet stiffer thus better handling as the car negotiated the topography of a road course. By 1955, “We had visual proof of the excellence of Chapman’s frame” according to

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[154] John Barnes, *Ferrari: 25 Years of Formula 1* (Scarsdale: John W. Barnes, Jr. Publishing, 1974). Page 7
[155] M. Jenkins, Tallman, S, "The Shifting Geography of Competitive Advantage: Clusters, Networks, and Firms," *Journal of Economic Geography* 10, no. 4 (2010). Page 613
[156] Alan Henry, *The Grand Prix Companion* (Cambridge: Icon Books, Ltd., 2007). pp 45-46
[157] Karl Ludvigsen, *Colin Chapman: Inside the Innovator* (Newbury Park: Haynes Publishing, 2010). Page 153

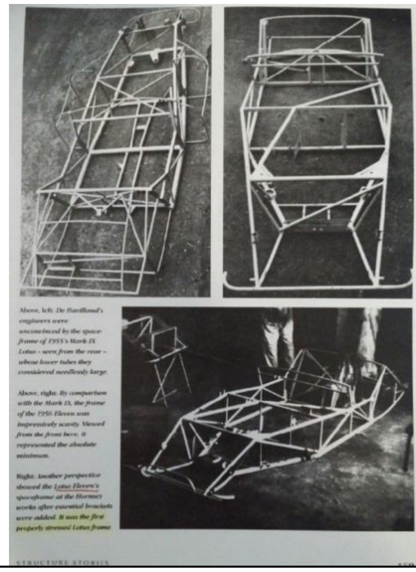

Fig. 2-2. Chapman space frame chassis. Top two are the Mark IX, and bottom is Lotus 11.Courtesy: Karl Ludvigsen, *Colin Chapman the Innovator*, page 159.

Ludvigsen's interview of Bill Boddy from *Motorsport* magazine, "because when a jack was raised under one side of the car the opposite front wheel rose in sympathy – rigidity *par excellence*."[158] Competition into the early 60s between Cooper and Chapman for cars to win in F1 was fierce whereby when Chapman introduced a new Lotus iteration it "misfired badly" in Argentina at a time when there was a four-month gap to the next race which, "gave the Cooper enough time to ready a robust counter-attack with its low-line Type 53."[159] This manifested situations which occurred with a fair amount of regularity in motorsports and business, to wit, deciding whether to be first to market (or implement) an innovation or to be a follower.[160]

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[158] ibid. Page 155 – italics in original

[159] Ibid. Page 25

[160] Mowery. Page 171. For an interesting analysis on "first to market" see, David Teece, "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing, and Public Policy," *Research Policy* 15, no. 6 (1986).

Fig. 2-3: Bernie Ecclestone. (Wikipedia)

The ensuing key figure in the evolution of the M/S industry was the physically diminutive but instrumental figure that was Bernie Ecclestone. It would not be questioned by anyone in the M/S community to state that BE was (and is) a living, breathing exemplar of Winston Churchill's 1939 broadcast commentary on Russia as "a riddle wrapped in a mystery, inside an enigma but perhaps there is a key. That key is Russian national interest." Simply replace the word "Russian" with the word "self". Taciturn and scheming, he also galvanized and grew a supra-elite group of F1 manufacturer's with hobbyist drivers in M/S to create enormous wealth for active participants and even more so for himself. At the same time his instinct, guile, and tenacity made top-tier global open-wheel racing known as F1, a safer and approachable global entertainment business network. Castells informs us that, "A network is a set of interconnected nodes."[161] and then sets out to provide numerous

[161] Manuel Castells, "The Global Network," in *Social Theory: The Multicultural and Classic Readings*, ed. Charles Lemert (Boulder, CO: Westview Press, 2010). Page 620.

examples of nodes to which can be added M/S circuits in that, “A network-based social structure is a highly dynamic, open system, susceptible to innovating without threatening its balance.”[162] Racetracks in F1, WEC, and NASCAR with their similar functions, purpose, physical attributes, capital intensive, need for special governance unlike any other space, and constantly innovating to meet technological, socio-technical, and socio-cultural demands of maintaining a dynamic forum of entertainment therefore are nodes of a network. This was especially true of the F1 series, the most capital intensive of all.

To understand BE requires a brief elucidation of his background. He was born in England during the Interbellum to a low-wage blue collar family. As an only child, he grew up in a household that did not make any celebrations for any event to include no birthday parties and no Christmas merriment. A diminutive child, he quickly realized that he wanted to be wealthy as an adult and in becoming very entrepreneurial he developed into an adult utterly devoid of sentimentality. Initially in primary school, he would buy a box of cookies and sell them on the playground for a tidy profit all the while keeping the good graces of the tougher kids to ensure the unimpeded business he had created. This morphed into him fixing and restoring bicycles at a profit, followed by doing the same with motorbikes where he gained notoriety for quality workmanship. So much so that motorbike racing world champion, Jack Surtees bought a refurbished model for his son John. Possessing what in the 21st century might be diagnosed as OCD (Obsessive-Compulsive Disorder), “He was so fastidious that even the labels on each bike were placed precisely in the same

[162] ibid.

position."[163] This behavior would follow him for the rest of his active life. While a secondary school dropout, he had a considerable knack for numbers and rapid mental calculations of value. As a ruthless negotiator, his skill and tactics would further grow his business to buy out entire motorbike businesses then proceed in the same manner to build a multi-location domain of used luxury cars favoring English brands. While an unsavory tactic, it was not uncommon in that industry at the time to roll back the odometer and his mechanics were compliant with his wishes to do so. All the while he was operating with a requirement of absolute efficiency in a neat and tidy environment – with many subordinates encountering a venomous wrath if they diverged from his edicts. Nonetheless, he built an automotive dealership empire.

In true alphabetical succession, the next name for many people should be Enzo Ferrari, but I disagree. While some may chide this decision, he was neither a radical innovator nor inventor. It is without question that in the world of F1, that Enzo Ferrari was *capo di tutti capo* and any F1-wide regulation changes, up to his passing in 1988, required administrative participants to "kiss the ring" and acquire his approval. However, the eponymous company that was Ferrari had incremental innovators but <u>**he**</u>, himself, was not an innovator. He was a leader but not a technological innovator and there is a difference.

[163] Bower. Page 19. The affliction OCD has been frequently linked to those also diagnosed with Attention Deficit Disorder (ADD). This author has been clinically diagnosed with the latter and regarding BE, his obsessive behavior will continue to be part of the narrative of his reign over F1.

Fig. 2-4: Bill France, Sr. Courtesy of snaplap.com

The final special entrepreneur/ innovator is the imposing figure known as “Big Bill” France, so monikered due to his 6’5” frame. His vision of a unified professional racing organization in America for regular, or “stock”, cars on closed oval tracks – under his leadership, if not command – has become the globally recognized NASCAR. A charismatic and natural promoter, France began racing at age 16 in his father’s Model-T by asking permission to drive it – but not explaining how he was going to drive it. A few years later, and tiring of repairing cars in Washington DC winters, he moved his family in 1935 to Florida with an intended destination of Miami but he became mesmerized by Daytona Beach. As he told Jim Foster years after the fact, his chief lieutenant in NASCAR, “I just blurted it out: Anne! This is it. We’re not going any farther. She asked if I was sure…The first time I saw Daytona Beach I thought it was the prettiest place I’d ever seen.”[164] Having been a racer imbued him with a unique perspective of race promoters of whom the majority at that time seemed less than savory in their integrity when it came time to pay top placing drivers. After promoting many races himself in partnership with the American Automobile Association (AAA), he parted ways with that organization in 1947 and in December of that

[164] Branham. Page 41

year assembled, "NASCAR's historic organizational meeting – from December 14-17, 1947, at the Streamline Hotel in Daytona Beach."[165] By the end of the 1950s his success resulted in the demise of all competing stock car racing (hereafter SCR) organizations and NASCAR had a firm grip on that type of motorsports in the eastern half of America. His crowning achievement, Daytona International Raceway, became a reality in 1959 and fully utilized in the early 60s as shall be explicated in the next chapter.

2.5 THE OUTLIER – RAYMOND LOEWY

In the following text having previewed Loewy above, we will also briefly introduce, and even further below elaborate on, John Fitch for racing safety, as well as Harley Earl for American car design and mass produced cars, and the creation of WGI. However, it would be inattentive to not denote a few lines to the influence on American automotive design and M/S enthusiasts by Raymond Loewy who was a French-born consumer-goods designer across a wide variety of industries from the Interbellum until his passing in 1986. Specifically, and with respect to automobile design, Loewy was responsible for a forward-thinking approach to cars, like the Chrysler Airflow and the unusual (yet strangely similar

Fig. 2-5. 1938 Chrysler Airflow. Courtesy: commons.wikimedia.org

[165] ibid. Page 63

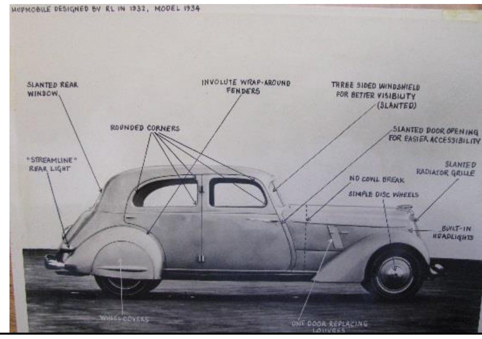

Fig. 2-6: Huppmobile exterior. Courtesy Hagley Museum and Library

to the Airflow) Huppmobile Model J Aero-Dynamic. Indeed, it should be no surprise at the similarity of the two vehicles as they both featured a propensity toward aerodynamics in conjunction with interior functionality. The Airflow's streamlined body had the lowest drag coefficient of any contemporary automobile but could not develop a foothold with the American consumer because it was so dissimilar from the standard American automotive offering and it only lasted from 1934-1937 (about the same lifetime as the Model J Aero-

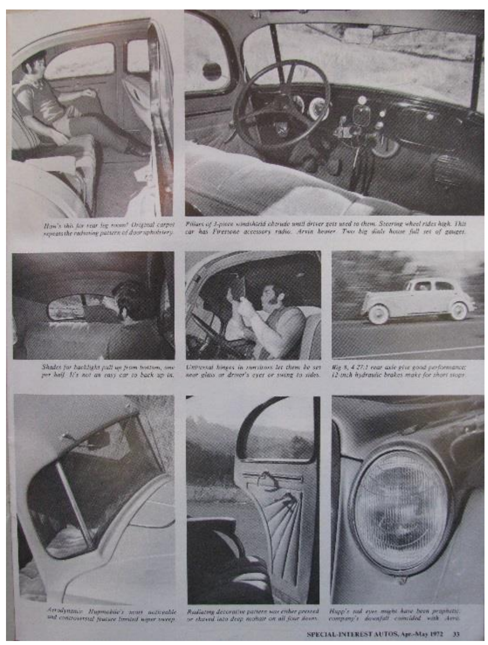

Fig. 2-7: Huppmobile interior innovations: legroom, adjustable front and rear visors, steering wheel position. Courtesy the Hagley Museum and Library.

Dynamic). Loewy's work on the Hupmobile allowed him to extend his design expressions by incorporating numerous hitherto unconsidered features for both the exterior and the interior.[166] His innovations were "comparatively radical" in terms of American desires and automobility.[167] These results led to his work for the Studebaker Corporation whereby he designed a number of truly unusual and passionately accepted, if narrow market-share, cars from the family-oriented Landcruiser in 1950 to the Starliner Coupe in 1953 and the most well-known Studebaker named the Avanti in the early 1960s. The Avanti will figure in the next chapter but in the 1950s, his work on the Starliner was followed with great interest as its physical profile was lower than other family cars and the styling was a bridge between American and European trends. Just like the media profile of his one-off BMW construction above, another magazine profiled the design process for the Starliner with several pages of photographs of that process.[168] As Paul Jodard notes, "Many enthusiasts bought Starliners and fitted [them with] more powerful engines: the so-called Studillac was a Cadillac powered version, much favored by hotrodders."[169] As will be explored in later chapters, customization of personal vehicles became an explosive industry and Loewy's design flair contributed to this phenomenon. This section's narrative cannot detour too much further into his legacy as it stretches beyond the scope of the document, but he was

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[166] Glossy photos; Box 2, Folder: Huppmobile 1932-1934; General Office, 1931-1982, bulk 1960-1977; Raymond Loewy Archive (Accession #2251), Hagley Museum & Library, Wilmington, DE 19807

[167] "Special Interest Autos" April-May 1972, page 33; Box 14, Folder 14: Huppmobile; General Office, 1931-1982, bulk 1960-1977; Raymond Loewy Archive (Accession #2251), Hagley Museum & Library, Wilmington, DE 19807

[168] "Birth of a Beauty" in *The Wheel*, April 1953, pp. 1-5; Scrapbook 33, Raymond Loewy Archives (Accession 2251), Hagley Museum & Library, Wilmington, DE 19807

[169] Jodard. 88-89. This was also manifest in competitive individual spirit of American drag racers profiled by Dan Post along with hotrodders profiled by Dave Lucsko.

unquestionably what is colloquially referred to as “car-guy”, and he was also consulted with regard to expanding a new circuit called “Lime Rock” in the state of Connecticut.

Originally conceived in 1955 concomitant with WGI and with direct involvement of John Fitch (who will figure prominently in M/S safety in future chapters), Raymond Loewy was brought in to design certain features benefitting both active and enthusiast participant areas

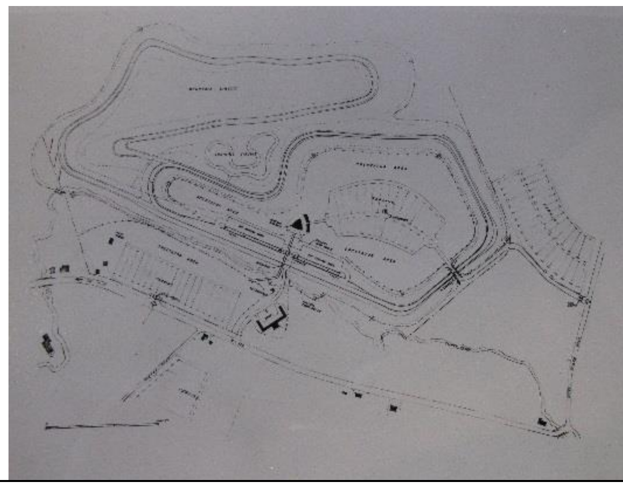

Fig. 2-8: Lime Rock Racecourse. Proposed extension is at top left. Courtesy Hagley Museum and Library.

as well as extending the course into the natural space beyond the initial layout. An obvious question might be why would Loewy be brought in to lend his design talents to the embryonic Lime Rock as opposed to helping design the more established and known racing area of Watkins Glen. One reason might be that Lime Rock lies much closer to the metropole of New York City, the “I-95 corridor”, and its extension into Connecticut versus the much more isolated contemporary M/S technopole of Watkins Glen. The 20 April 1957 press release from the Raymond Loewy Corporation touches on the technology transfer for safer passenger cars as a result of racing (independent suspension, four-wheel brake systems, etc.) and postulates that work being done on track surfaces in conjunction with

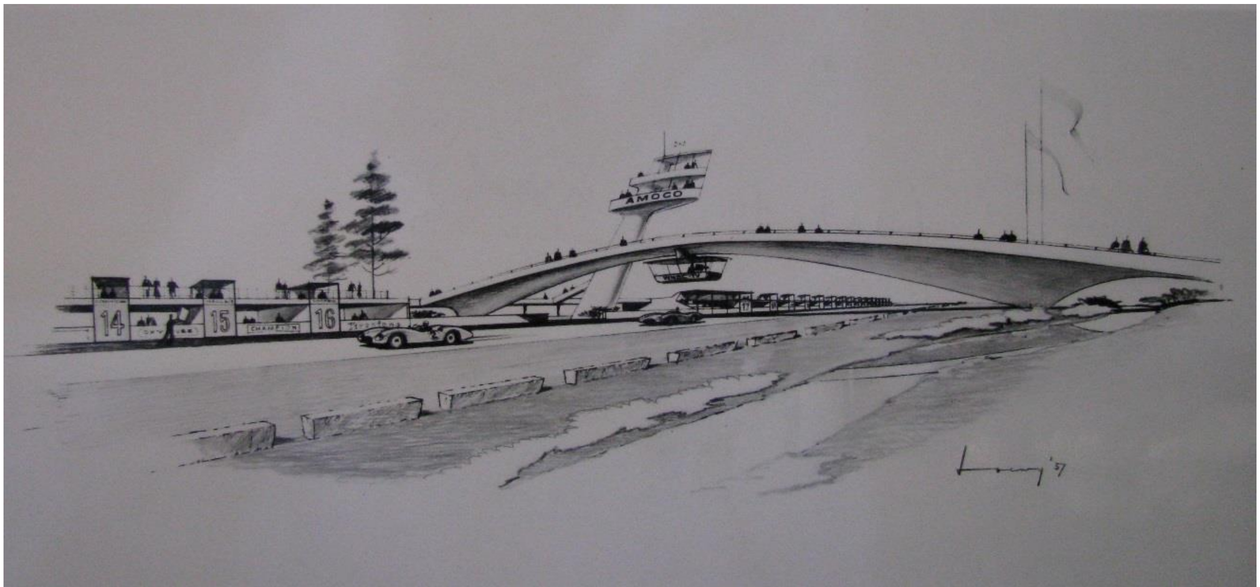

Fig. 2-9: Loewy's text on obverse of this image states: "…at the starting line…The modern overpass cradles a TV booth in a suspended gondola. Pits are sunken for maximum safety; timers' booths and observation area raised. The tower is reserved for judges and officials of the races." Courtesy of The Hagley Museum and Library

Cornell Aeronautical Laboratory research into materials, configurations, etc. "will yield comparable advances in the design of roads." according to Fitch.[170]

Loewy's vision went far beyond the coterminous thinking of how a racetrack should be seen as illustrated in the rendering above. His progressive designs were intended to incorporate the enthusiast participant experience at much higher levels of satisfaction than track experiences hitherto. Unfortunately, unlike the denizens of Watkins Glen, those who resided near Lime Rock were definitely opposed to the facility leading to the abandonment of the European road racing based extension and Loewy's plans. The compromised end

[170] Press Release 20 April 1957, Box 14, Folder "Lime Rock Race Course 1957", Raymond Loewy Archive (Accession 2251), Hagley Museum and Library, Wilmington, DE, 19807

result in 1959 was a prohibition on holding any races on Sunday which is the traditional day that races are held.[171]

2.6 THE SPORT

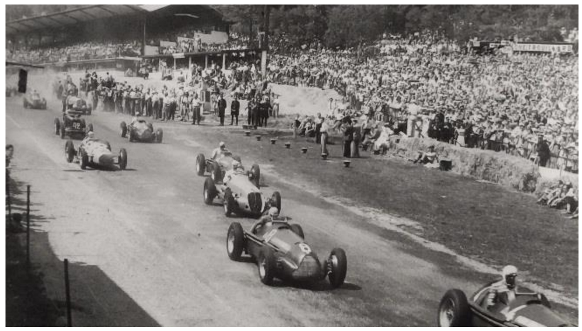

Fig. 2-10: Former start/finish line of the 1950s at Spa in Belgium. Notice “protective barrier” bales on the right side of image. Courtesy of Wikimedia Commons

Generally speaking, across the early years of this period, management of, and the desire to be any one of the participant types, was essentially unchanged since the interbellum. American stock car racing (hereafter as SCR), especially what took place in the southeast, was negatively perceived by a majority of the national populace as a collection of noisy, drunken, hooligans and ne’er-do-wells. Grand Prix and endurance racing in Europe celebrated the “hero” drivers who challenged mortality in pursuit of their hobby. Safety was minimally addressed, if at all, in terms of protecting spectators or drivers to the detriment of the sport. The lack of technical regulations for protecting fuel tanks in order to inhibit fires led to several spectacular fiery fatalities across Indianapolis 500, the various SCR series, F1, and WEC. The result was what one might expect – public backlash that

[171] Philip M. Parker, *Motorsport: Webster's Timeline History 1904-2007* (San Diego: ICON Group International, Inc., 2009). As to why Sunday became the traditional race day, it is unclear at this stage of my research and may warrant further exploration later.

severely curtailed expansion of motorsports. It is necessary to remind the reader that: 1) drivers had no seatbelts at the beginning of the period because the greater fear was death or injury from fire due to entrapment in a burning car; 2) components de-coupled from cars and, either by stress failure or impact, bounced into spectator areas; and 3) cars involved in crashes sometimes left the racing surface landing in the grandstands due to no barriers. If anything was positioned as some form of barricade between active and enthusiast participants, it was bales of hay or straw.

However, an *in situ/in tempus* case can be argued that, because of WW II and the enormity of people who experienced first-hand traumatic events, motorsport participants might have been anaesthetized to a certain extent from the carnage until the volume of tragedies reached a turning point.[172] This *niveau* was attained in 1955 after the most catastrophic event in auto racing history at the 1955 *24Heures du Mans* at the Circuit de la Sarthe in LeMans, France which will be further profiled in a later chapter. A race-car came in contact with another car and vaulted at top speed into the main, front-stretch grandstands across from Pit Road killing more than 80 people and injuring almost 200. The ensuing fire exacerbated by uninformed and unwitting fire crews pouring water on burning magnesium wheels exponentially worsened the situation. What is more, the race was neither temporarily halted nor ended while bodies and casualties were removed. This was another turning point in the history of motorsports (hereafter as M/S).

In Europe, M/S of all types was banned in Switzerland and still is to this day, Mercedes-Benz left racing completely until their return in 1989, and many other countries began

[172] See comments in Westin, "Motorsports and the Motoring Public at Full Song (1950 to 1965): Measuring Men, Creatively Destroying, or Stimulating Technology?." Page 16

inquisitions into M/S.[173] This same year, the legendary and highly skilled Alberto Ascari driving a Lancia D50 crashed into the Monte Carlo harbor after exiting the Hotel tunnel as there were no barriers.[174] In America, gruesome immolations of top drivers in NASCAR and especially the well-respected Bill Vukovich at the Indianapolis 500, in addition to unsecured drivers succumbing to fatal injuries by ejection from vehicle or poorly secured components, caused the fledgling support by manufacturers to be withdrawn. The Automotive Manufacturers Association (AMA) in 1957 seized upon the unpalatable violence of contemporary auto racing to withdraw all support, indeed banning any factory support for any racing. However, to contextualize this narrative, Ford historian Leo Levine is quoted in Pierce's monograph *Real NASCAR* that "engineers…now had 'the monkey on their backs' to produce faster, better-handling, and more durable cars 'and they didn't like it'''[175]

From a regulatory standpoint, all of the series' examined herein were in the nascent stages of attempting to control and/or standardize order as sanctioning entities. In some ways this odd chess match of building a M/S network can be likened, to a degree, to the efforts to regulate early American railroad networks with their disparate masters, geographies, and technical specifications, M/S in the 1950s had a variety of circuits and race organizers, as well as different technical specifications and topographies.[176] As intimated above there had been virtually no rules proposed or established to safeguard either active or enthusiast

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[173] Rendall. Page 61

[174] Alan Henry, *Grand Prix Circuits: A Tour of Formula 1 Circuits from Starting Grid to Chequred Flag* (Osceola: Motorbooks International, 1997). Page 37. He survived but it happened again to another driver in 1965.

[175] Pierce. Page 185

[176] Steven W. Usselman, *Regulating Railroad Innovation : Business, Technology, and Politics in America, 1840-1920* (Cambridge, U.K. ; New York: Cambridge University Press, 2002).

participants even after the multiple tragedies. As a result of the horrific human toll at LeMans in 1955 and losing five of the top ten drivers in NASCAR in the first half of 1955, the American Automobile Association (AAA) "would 'dissociate itself completely from all forms of auto racing in the United States' and disband its Contest Board."[177] That said, one significant NASCAR rule change did occur in 1955 when 4-point roll cages were introduced which resulted in a safer protective canopy around the driver.[178] The overwhelming majority of regulatory changes in F1 in this phase encompassed engine size and configurations as well as drivetrain details.[179]

2.7 THE RACE SPACE – Watkins Glen

Watkins Glen is at the southern end of Seneca Lake in the heart of the Finger Lakes region of New York State. Originally settled in 1791, it was named Watkins in 1852 and the suffix

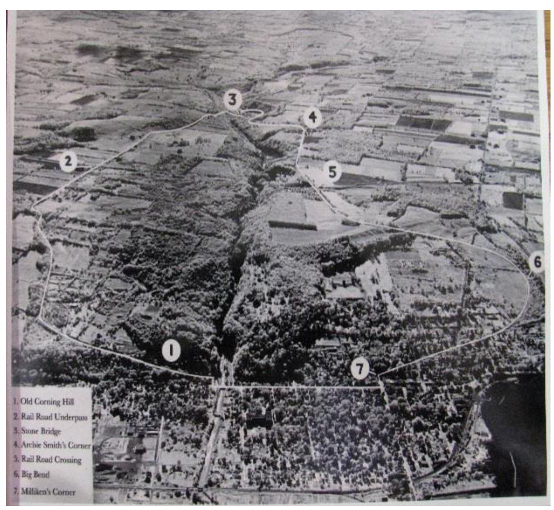

Fig. 2-11: Aerial view of the circuit. Book I – Watkins Glen Race Tracks: 1948 – 1955, William Green Library, IMMRC, Watkins Glen, NY 14891

[177] Pierce. pp 182-183
[178] Tom Giddeon, "Nascar Safety Initiatives through the Years," (Charlotte, NC2015).
[179] FNU LNU, "Http://Www.Formula1-Dictionary.Net/Engine_Rule_Changes_History.Html," in *www.formula1-dictionary.net* (Rijeka, Croatia).

"Glen" was added in 1926.[180] Already a destination for tourists because of the lake, the wine country, and a spectacular gorge in the center of the village which is a registered National Park, it still welcomes visitors at the city limits with a sign stating, "The Village of Watkins Glen".

This race space is situated in this chapter because it was during this phase that it was formed. Racing here took place across three spaces starting in 1948 which I will refer to here as Mainstreet, Fields, and Built. Briefly profiled above, Cameron Argetsinger grew up in Ohio as the son of a successful attorney for Youngstown Steel and Tube Company and who had a summer home by Seneca Lake. In addition, Cam's grandparents lived in the Schuyler County area with its three thousand residents, so he spent most of his formative

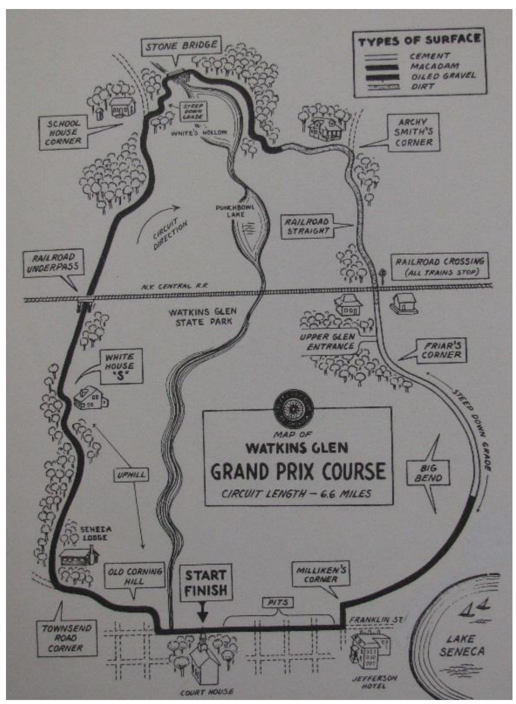

Fig. 2-12: Course layout. Notice the railroad line bisecting the course from left to right. Courtesy: International Motor Racing Research Center (IMRRC)

[180] "Watkins Glen," in *The New Encyclopeadia Britannica*, ed. Phillip Goetz (Chicago: Encyclopaedia Britannica, Inc., 1988). Page 526b

summers in this area. His father's enthusiasm for Packard's was at the root of Cam's automotive interest and following his postwar military discharge, he both entered Cornell Law School and began formulating how to bring European-style road-racing to America. This eventually led to his membership in the Sports Car Club of America (SCCA) which was an embryonic group formed in 1944 "to protect classic pre-war American cars from the scrap heap."[181] a similar mission which more than fifty years later is outlined by Dave Lucsko to protect older and nostalgic cars from being crushed.[182] This organization became the *de facto* sanctioning and rules body for American sports car enthusiasts however, unlike the subsequent global FIA, F1, NASCAR, WEC, etc. it "decreed that road racing in the United States would be for amateurs only – no drivers could be paid for racing."[183]

However desirous Mr. Argetsinger was of establishing this road race, it still required approvals and authorizations from regulatory agencies at state and local levels. The proposed course touched a number of these entities such as the municipality of Watkins Glen, the National Park entrance, state highways, and the highly unusual for M/S, New York Central Railroad. Following a series of detailed letters among several people and offices from July to October 1948 permission was granted by all applicable officials to conduct the early October event.[184] This included coordination to temporarily delay trains from running during the race as they would have activated the crossing barrier and blocked the road. In a meeting that replicated another venue hundreds of miles to the south and a

[181] Defecheraux. Page 4
[182] David N. Lucsko, "Of Clunkers and Camaros: Accelerated Vehicle Retirement Programs and the Automobile Enthusiast, 1990-2009," *Technology and Culture* 55, no. 2 (2014). Pages 390-428
[183] Defecheraux. Page 5
[184] William Green, "Book I - Watkins Glen Racetracks 1948 - 1955," in *William Green Motor Racing Library*, ed. International Motor Racing Research Center (Watkins Glen).

year earlier at the Streamline Hotel, a group of men gathered at a place named Seneca Lodge located approximately one mile uphill (and on the course) from Mainstreet to coordinate the administrative, logistical, and operational requirements of conducting a brand-new road race in America. Over time, Seneca Lodge came to be the informal home for active participants where they demonstrated in real-life the glamorous and, to some, debaucherous antics and behaviors so often ascribed to professional race-car drivers and mechanics. An actual hotel with cabins as well, it is still currently the same family run establishment resplendent in wooden décor befitting the term “lodge” as when Argetsinger began forming his vision of American road-racing.

Fig. 2-13: The author’s wife with IMRRC Historian Bill Green at Seneca Lodge and distinctive wooden décor. Personal photo.

2.7.1 MAINSTREET: 1948-1952

A 6.6-mile course laid out across the bucolic New York countryside, the space used between 1948-1952 was comprised of multiple topographical changes, landscapes, and road surface materials. The prospect of an international occurrence taking place in the village was received with great anticipation as the interim population was expected to soar from a few thousand to almost ten times that number bringing with it an economic windfall to the village and surrounding area. Townspeople did not seem to mind the potential takeover of their Mainstreet (actual name was, and still is, Franklin Street) by hordes of visitors such that those "guests" would request, and receive, permission to, in effect, camp on resident's lawns due to impossibly inadequate hotel supply.[185] This was wholly accepted by both parties as part of the charm/thrill of the race experience.

Fig. 2-14: Smalley's Garage. Cars would pass through the white portage on the left from behind the building for pre-race scrutineering. Personal photo.

[185] Scaptura, James; "Grand Prix Memories in the 50th Anniversary", 4June 1999; Box 99A10; Jim Scaptura Collection; International Motor Racing Research Museum, Watkins Glen, NY 14891. In 2018, the issue of adequate hotel supply during racing events remains an issue.

More than just a race, it was a weekend devoted to the automobile and it was not lost on the denizens of the village as most of them had never seen "such exotic things as Alfa-Romeo's, Maserati's, MG's, Ferrari's, and Jaguar's. The first time I saw those cars I was awestruck."[186] In addition, it was the multi-sensory stimulation of a large variety of cars from different classifications offering more than 200 entrants the opportunity to compete with cars they drove to the race. The arbiter of this opportunity was a place known as Smalley's Garage where technical inspections took place to: A) validate proper classification, B) enforce technical violations before the start of any competition, and most important of all C) check the soundness of work done by owner operators to ensure safety as most were home-made efforts. Cars would pull in behind the station in two lanes, receive inspection and pull out onto Mainstreet toward their respective garage areas. At modern-day facilities, servicing of race cars takes place in a hardened separate space and parallel to the main competitive space, however in the late 40s and early 50s Watkins Glen, these

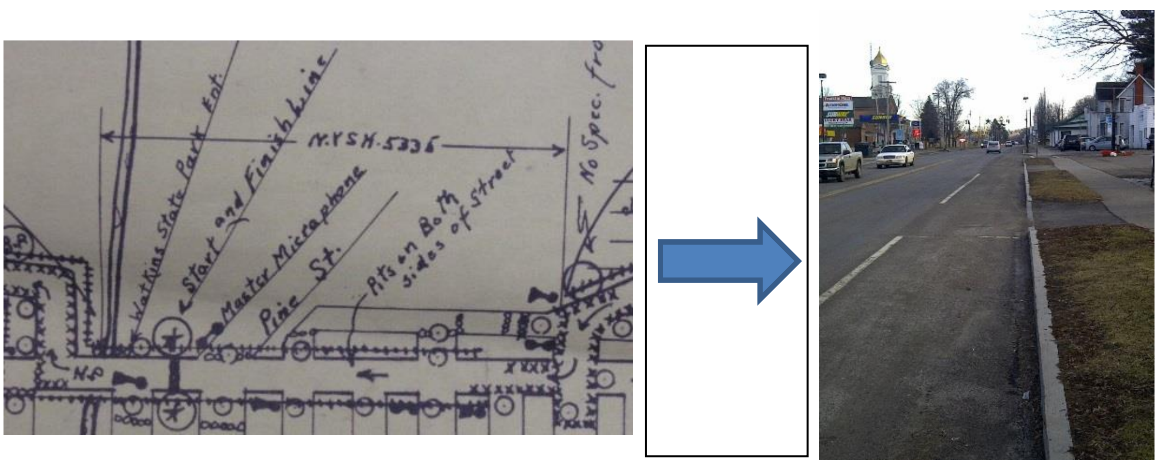

Fig. 2-15(a) and (b): On the left (a) is the Pit area plan for Mainstreet. See notation of Pit Box locations on center-right of image. On the right (b) is the actual space. Some teams worked on cars on the asphalt inside the white line, while others pulled onto sidewalk area. (a) Book I – Watkins Glen Race Tracks: 1948 – 1955, William Green Library, IMMRC, Watkins Glen, NY 14891; (b) Personal photo.

186 Ibid

service areas were essentially the every-day parking spaces adjacent to the main traffic lane through downtown. Concurrently, full speed competition took place in unseparated space through what had been the heart of a small town that almost overnight became a city with no substantial physical barriers between enthusiast and active participants. Once the drivers left Main Street the route became distinctly pastoral though with a much disturbingly louder pronouncement than Leo Marx's train whistle.[187] Traversing the countryside also

Fig. 2-16: Right turn from Mainstreet uphill away from town. Courtesy IMRRC.

meant navigating unique obstacles not encountered in European courses such as railroad overpasses, curved rock bridge with no protective siding, tricky macadam surface, and eventually a railroad crossing. The final segment of the circuit is a very long downhill clock-wise curve that invoked (and still invokes) the sensation of Italy's iconic and immensely difficult Monza course segment known as the Parabolica.[188] At the culmination of this steep downhill portion are two-fold, left-right, ninety-degree turns expelling drivers onto the Mainstreet straightaway, and where many a driver misjudged their speed or the cars' handling ability.

[187] Much of the race course snaked along the national park and aside from the trail and bridge was through undisturbed space and farmland. Leo Marx, *The Machine in the Garden, Technology and the Pastoral Ideal in America* (New York: Oxford University Press, 1964, 2000).

[188] When driving on this descending and sweeping curve, the current speed limit varies between 45-55 mph and there is no "banking" commonly found on modern curves and turns thus exaggerating an off-camber sensation where inertia and the laws of physics wants to push the vehicle into the oncoming lane.

Professionally managing these races on the part of administrative participants was important to Mr. Argetsinger and is significant because at counterpart facilities in Europe, there was an ambivalent arrogance indicative of the time toward safety which manifested itself in complete disregard of coordinated safety and rescue efforts on behalf of active participants, crowd control of enthusiast participants, and a variety of other concerns. While there may be organization charts of European circuit management by administrative participants from the 1950s, they are currently unknown to this author and, frankly, it would be a surprise to find. One critical element of managing the organization of a race is the ability to accurately determine lap speed of each car and one of the technologies available to these organizers is in the image on the previous page. The reason for two timers is to have one in active timing mode while data from the other can be manually recorded onto a sheet and then re-set for the next lap.

Fig. 2-17: Lap timer. Dave Hoffman Collection (99A65), IMRRC, Watkins Glen, NY 14891

As we transition to examining the physical track surface, it is particularly interesting to grasp the uniqueness of the Watkins Glen circuit. All top-level racetracks before and after racing commenced here were comprised of one material – typically compacted asphalt or dirt. Where the competitive space of Watkins Glen set itself apart was that it was comprised of several different materials as shown in greater detail in the picture on previous page.

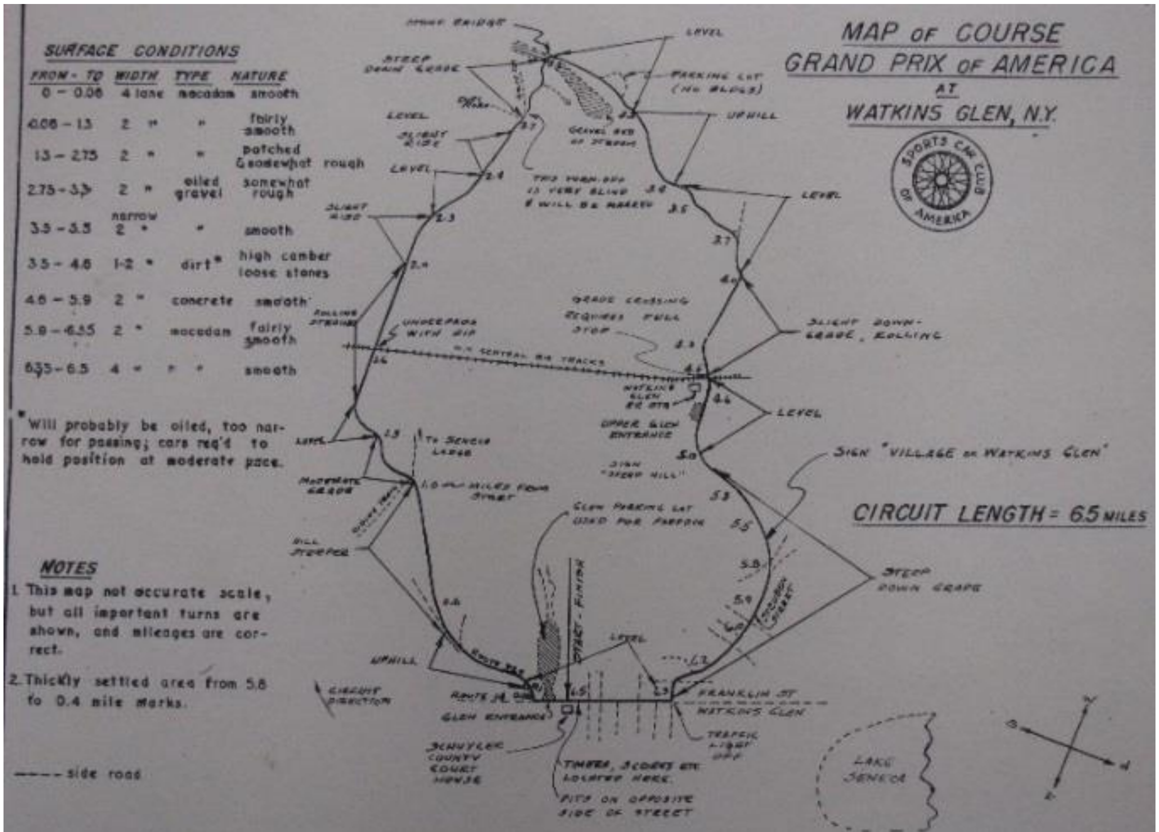

Fig. 2-18: Course surface material. Book I – Watkins Glen Race Tracks: 1948 – 1955, William Green Library, IMMRC, Watkins Glen, NY 14891

This is significant because maneuvering on a consistent surface is somewhat predictable, yet multiple surface types is an upsetting calculus to determining optimum suspension, handling, braking, and acceleration. Other than World Rally Championship (WRC) which is out of scope for this dissertation, no other venue in road racing has either in the past, or in current competition incorporated this variable into the competitive landscape.

What was furthermore incredibly special about the original circuit was the existence of three major safety issues: driving under a railroad bridge, crossing a curved stone bridge over a wide running creek, and crossing over an active railroad line. The first problem is the matter of having speeding drivers/cars mediate their competitive impulses, slow down to a regulated speed, and then immediately re-initiate maximum speed on the other side of the bridge. The next unfathomable scenario for top-tier, high-speed racing is an obstacle that existed in no other road or oval M/S venue. A steep downhill, off-camber, curvy gravel extension from the previous asphalted surface approaches The Stonebridge. The course makes a distinct right turn to the bridge which, as can be seen in the photo has a very low wall, crossing a flowing creek about 20 feet below in White's Hollow. No car would have been prevented from vaulting into water below as the top of the stone wall stops below an adult's knee-cap. Immediately after Stonebridge the route meanders across a short plain followed by an uphill and densely wooded section on the opposite of the Hollow where the right side was (and still is) a steep drop-off of between 30-100 feet as it graduates upward with no barrier at the time other than trees. Finally, there is no M/S space that had, has, or ever will have the course to cross over an active railroad line – except Watkins Glen from 1948-1952. It would be widely agreed upon as absurd in current time, or during Interbellum atmosphere, to accept as true that any railroad entity would remotely consider inhibiting its schedules (and profit margins) for a motor car race. Resistance by these companies could be considered similar to the mindset of railroad barons on either side of the 19th to 20th century change.[189] Thus it is further astonishing that the nascent American M/S movement was able to convince the New York Central Railroad to abate rail movement for an entire weekend in favor of automobile races at Watkins Glen.

[189] Usselman. Various chapters

Fig. 2-19: Railroad bridge. On the left side of the road is a white mailbox for a house built prior to the competitions. Personal photo.

Fig. 2-20: Stonebridge. On the right is sign to mark 3-mile point of original course. Drop to creek below is 20 feet. Personal photo.

Fig. 2-21: Railroad crossing is on straightaway and does not have bump to launch racecars out of control. Personal photo.

Nonetheless that is exactly what transpired. On a separate note, there was a revealing post-race comment of the Schuyler County Assistant Engineer of Public Works can be seen as foreshadowing. In a letter to H.F. Brum, the District Engineer, and despite positive post-race comments, John C. Cronin stated that, "I witnessed the Grand Prix Race…" and completing his communique with, "I would like to recommend that we substitute a Tournament of Peaches for Oct. 1949 and eliminate the danger of mass killing by a bad wreck."[190]

Over the ensuing four years there were many developments, spanning the socio-cultural to the technological, but four in particular will be discussed below. By 1950, spectators and visitors outnumbered village residents by a ratio of ten to one during the racing weekend in October. A major destination for many was the comparatively sprawling grounds of Seneca Lodge owned by Don Brubaker who was one of the founding members of the WGGPC. Therefore, it was an interesting revelation that apparently the road which went by this property had been properly paved only from the village to the lodge's entrance. A letter dated 5 August 1950 from the Schuyler County Dept. of Highways to the SCCA

Fig. 2-22 (a) and (b): Two views of entrance to Seneca Lodge, virtually unchanged from 1948. Personal photo

[190] Book I – Watkins Glen Race Tracks: 1948 – 1955, William Green Library, IMMRC, Watkins Glen, NY 14891.

advises of the completion of repaving the 2.6-mile stretch from "Seneca Lodge to the Schoolhouse Corner."[191] The endpoint of this project was precisely where the course left the main road for the passage into the National Park toward the Stonebridge mentioned above. The letter also reminds that it took, "considerable persuasive conversation" by the department and a City Assemblyman travelling to New York state capital in Albany, enabling completion in time for the 1950 Grand Prix.[192]

Fig. 2-23: Communications network. Inside yellow drawn shape is a tree-mounted terminal connection approx. 15 feet above ground in the vicinity of station 21 or 22. Personal photo.

Second, and of more monumental import to this narrative was the evolution of communication during races as an element of safety procedures. For the first three years reliance on informing the entire field of localized incidents rested with a few amateur short-wave radio operators.[193] The fatal crash of Sam Collier was the catalyst for change in this method. Dr. James Norton took his post at the Schoolhouse Corner ambulance station and after a couple of laps of the main Grand Prix race a driver slowed down to indicate the need

191 Ibid.

192 Ibid.

193 James Norton, MD, interview by Michael Argetsinger, 2003, Watkins Glen. Page 4 Dr. Jim Norton Interview (03A33) IMRRC, Watkins Glen, NY

for his services somewhere behind the driver.[194] The race was underway as he and his driver maneuvered into oncoming traffic until they came upon the accident scene, picked up the still breathing patient and transported him to the hospital where he subsequently died. In the following after-action review (AAR), Dr. Norton made his case for changes to the process and was introduced to a like-minded gentleman named Fred German with connections to Eastman Kodak for image replication.[195] They developed a plan using what is commonly known as "land-line", or wire, circumnavigating the entire perimeter connecting many stations which was presented to the Board and immediately approved. The end result was that for the 1951 race they had 31 safety stations with four persons at each station and a system using more than 28 miles of phone wire, "four safety districts,

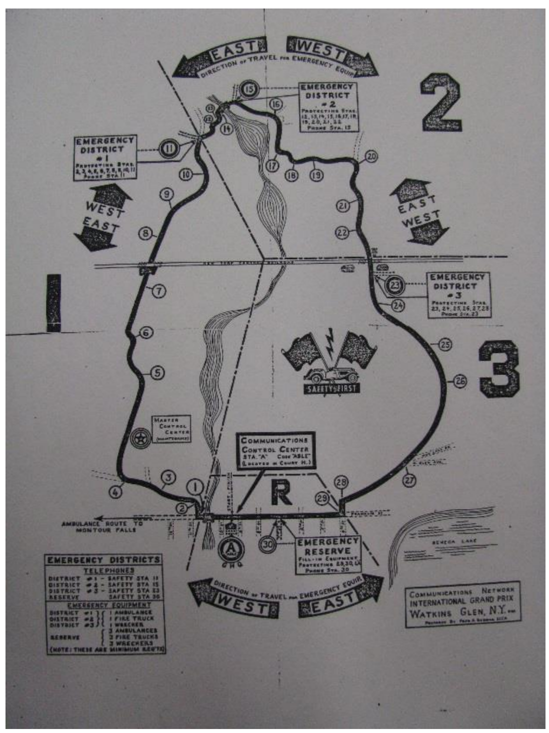

Fig. 2-24: Track safety and RCA stations. Book I – Watkins Glen Race Tracks: 1948 – 1955, William Green Library, IMMRC.

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[194] This station was one of a dozen across the 6.6-mile course

[195] Dr. Jim Norton Interview, Ibid. pp. 4-5

each having at least one ambulance, a fire truck, and a tow truck”. This organization had been given the name of Race Communication Association with a motto of “Safety First”.[196] As will be elucidated upon in later chapters, this swift enaction of corrective measures to safeguard all participants is diametrically opposite, in a positive way, from behaviors of concurrent and subsequent administrative participants in Europe. Indeed, a question might be, why did the commonly known flags not help in the 1950 incident?

The use of “flags” in M/S is almost universally understood, in part due to colloquial use of the term “green flag” meaning to proceed with something and “checkered flag” to indicate completion. That said, flags would not have helped because their use is to inform drivers before arriving at an incident which was not the experience of Dr. Norton, et al. In discussion of flags, research for this dissertation uncovered that flags were only used at WGI races from 1948-1951, stock cards in 1952, and wooden paddles during the Field races 1953-1955, and returning to flags permanently at the Built circuit. For the benefit of the uninformed (and looking at the wooden paddles in the photo to the right): “green” means full-scale racing is under way, “red” means the race has been stopped usually for weather or major incident clean-up, “blue” tells a slow driver that a faster driver wants to

Fig. 2-25: Wooden paddles, 1953-1955. Courtesy: IMRRC, Watkins Glen, NY. Personal photo

[196] Defecheraux. Page 125

get around him so he must move over, and the red/yellow striped paddle means slow down for a localized incident. Track safety personnel at stations around the course would manually display the situation by waving these indicators.

Third, and as mentioned earlier, the entire weekend was in support of the GP race and devoted to cars. So much so that every year it had its Concours d'Elegance whereby owners of resplendent automobiles displayed them in cordoned off areas after a ceremonial parade lap around the circuit. Those were classical cars even then as they were from the Interbellum and pre-World War One with elegant body styles and naming attachments such as Phaeton, Landau, Brougham, Cabriolet, Brilliante, ad inf.[197] This event known simply as Concours was meant to evoke nostalgic extensions to very early 20th century when Paris was the center of all things automotive because of *carossiers* who hand-sculpted metal bodywork, seats were hand-tufted, and finished product was the envy of many. At this point in the sociotechnical realm of automotive history, there was no larger gathering of people at one time in America with like-minded interest in automotive technology, style, and performance. On race weekend the resultant extravaganza was complete, aural, "scentual", social and visual stimulation.

Fig. 2-26: 1934 Packard 12 Phaeton at 2007 Concours d'Elegance at Pebble Beach. A similar model as would have been shown at WGI. Wikimedia Commons

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[197] Lennart Haajanen, *Illustrated Dictionary of Automobile Styles* (Jefferson, NC: McFarland & Co. , 2003).

Fig. 2-27: 1951 Le Sabre concept car by Harley Earl that was premiered at WGI. Wikimedia Commons

However, in 1951 there was a surprising, to many, arrival of Harley Earl's concept car Le Sabre but in retrospect, this made perfect sense. It had "14 electric motors to power a vast number of gadgets", and "60 controls and gauges [to] operate and monitor [a] vast array of amenities" such as rain sensitive plate under seat fabric to automatically close the convertible top, seat warmers, built-in hydraulic jacks for each wheel and a supercharged V8 producing 300 HP.[198] So the irony was not lost when, after leading the Concours D'Elegance around the circuit, the "Le Sabre stalled and they couldn't re-start it…I walked down Franklin St. beside the car as they pushed it" and Harley Earl was visibly upset.[199] The significance here is that Earl was considered, unequivocally by the automotive industry, the master of American car design for General Motors (GM) from the 1930s through the 1950s. Like Thomas Edison, Henry Ford, William Shockley, and many other remarkable inventors/designers, he was absolute in his beliefs and could mentally picture what something should look like but ranked very low with respect to human interaction skills.[200] Of further interest is the inspiration he found at WGI for what would become the

[198] Defecheraux. 124
[199] James Scaptura, 1999.4. Jim Scaptura Collection (99A10), IMRRC, Watkins Glen, NY
[200] Armi. 24-34

legendary Corvette brought to production by Chevrolet chief engineer Ed Cole and the Belgian-born mechanical engineer Zora Arkus-Duntov. It is not within the scope of this writing to elaborate on the history of Corvette but it is sufficient to state that it became a storied program under Duntov that has been active in motorsports on-and-off for several decades – and considered to be "America's only sports car (in the absolute sense.)"[201]

The final of the four interesting evolvements was in the attempt at harnessing natural laws of science. Briggs Cunningham, a driver from Ohio and very influential at the WGI races, was born into considerable wealth and made a premature leap into aerodynamics for race-cars at the 1950 Le Mans by qualifying a highly customized Cadillac, called "*Le Monstre*" alongside a team-mate in a regular Cadillac as he wanted to hedge his bets for the competition. As you can see from the image, his theory was that a lower profile would reduce drag coefficient and lead to a higher finish standing. Underneath the bodies, the two cars were identical with chassis, motor, etc. Unfortunately for Briggs, the multiple other factors relevant to extracting milliseconds (handling, braking, acceleration, etc.) did not

Fig. 2-28: Briggs Cunningham's team of Cadillacs with a regular version on the right and "*Le Monstre*" on the left. From racer.com – accessed 31Mar2018

[201] Leon Mandel, *American Cars from Harrah's Automobile Collection* (New York: Stewart, Tabori, & Chang, 1982). 347

coalesce to the extent he desired which, coupled with spending 20 minutes digging out from an off-track excursion, resulted in a respectable 11th place but still behind the team's other "Caddy". As an homage to Cunningham's endeavor to innovate, Cam Argetsinger drove "*Le Monstre*" as the pace car during the 1950 WGI Grand Prix but was then retired. One more example of the Mokyrian "Leonardo Problem", it would be another decade before aerodynamic manipulation was addressed again in Grand Prix racing.[202]

Racing through Mainstreet came to a stunning and somewhat gruesome closure in 1952. It must be re-iterated here that questions have been asked whether it is possible that *in tempus* cultural acceptance of danger and risk or tolerance for tragedy might have been higher for adults due to memories/experiences from either World War II or the Korean War. For some, high-risk activities were to exorcise demons from the mind as portrayed in Wade Davis' book *Into The Silence* about George Mallory and his men in their assault on Mt. Everest after The Great War – these would most likely be active participants in racing.[203]

Fig. 2-29: Spectators behind thin wooden slats lining Franklin Street "Front" Stretch. Courtesy IMRRC.

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[202] Mokyr. 146

[203] Wade Davis, *Into the Silence: The Great War, Mallory, and the Conquest of Everest* (New York: Alfred A. Knopf, 2011). While I have not read the book, I was informed of it by Marionne Cronin while writing my SHOT Technology Stories online article and have read newspaper reviews of this book from the New York Times, Washington Post, England's The Guardian among others.

For others who have strong preferences for risk taking, "this tendency may be compounded by experience gained in the military" and when combined with "groupthink [to] develop a strong culture with well-defined norms and codes of behavior" lead to making questionable decisions – primarily on the part of enthusiast participants.[204] In his 1993 article in *Sociology of Sport Journal*, Kevin Young informs of the English "common-law notion of ***volenti non fit injuria,*** or voluntary assumption of risk, is based on the assumption of freedom of contract and assumes that management and labor share equal knowledge in all areas of work, including such things as hazards, risks, and medical information"[205] In conjunction with unbridled enthusiasm of being in attendance at the event itself, these could be factors in trying to make sense of the unfettered access and unprotected status of observers lining both side of Mainstreet and beyond. The spectators knew it was dangerous and they willingly took this risk, but it led to some dire consequences.[206]

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[204] R.J. Knighton, Wing Commander (RAF), "The Psychology of Risk and Its Role in Military Decision-Making," *Defence Studies* 4, no. 3 (2004). 325, 328

[205] Kevin Young, "Violence, Risk, and Liability in Male Sports Culture," *Sociology of Sport Journal*, no. 10 (1993). 383, bold in original. Alan Henry, ed. *Autocourse: 50 Years of World Championship Grand Prix Motor Racing* (Somerset: Hazleton, 2000). Page 27

[206] For various perspectives on Free Will and accountability see: C. Arthur Campbell, "In Defence of Free Will," in *An Introduction to Ethics*, ed. Robt. Dewey, Hurlbutt III, Robt. (New York: MacMillan Press, 1977).; Jonathan Glover, *Causing Death and Saving Lives* (New York: Penguin Books, 1981).; Jeffrie Murphy, "The Killing of the Innocent," in *War, Morality, and the Military Profession*, ed. Malham Wakin (Boulder: Westview Press, 1981).; James Rachels, "Egoism and Moral Skepticism," in *Philosophy: The Basic Issues*, ed. E.D. Klemke, Kline, A, Hollinger, R. (New York: St. Martin's Press, 1982).; John Rawls, "Two Concepts of Rules," in *An Introduction to Ethics*, ed. Robt. Dewey, Hurlbutt III, Robt. (New York: MacMillan Publishing Co., Inc., 1982).; W.T. Stace, "Ethical Relativism," in *Philosophy: The Basic Issues*, ed. E.D. Klemke, Kline, A, Hollinger, R. (New York: St. Martin's Press, 1982).

Fig. 2-30: The fatal incident is just taking place outside the right edge of frame. Also notice on the left side the track worker with stock cards in lieu of flags or paddles. Courtesy IMRRC.

The first lap of the final race for GP contestants had just been completed with the aforementioned Briggs Cunningham in the lead by a large margin over John Fitch (who will figure prominently in safety efforts for next several decades) with driver Fred Wacker rapidly approaching from third position. As is common in M/S, the realization on the part of a driver (Fitch) of the sudden appearance of another car causes a brief corrective action to prevent a crash, but in this case, it was too late. The back end of Wacker's car abraded the teeming crowd that had been pressing the boundaries of spectator area injuring ten people and killing 7-year old Frank Fazzari (Fig. 2-32). As a consequence, medical staff was stripped from all stations to attend to patients on-site at the end of the front stretch and the race was red-flagged shortly thereafter for many reasons.[207] In the words of then 18-year old Jim Scaptura, he "saw Freddy Wacker's car as it went into the crowd. We knew it wasn't good. I was sick the next day, and I'm still not sure whether it was the food I ate or what happened that caused my stomach to be upset. I missed three days of school and

[207] Dr. Norton Interview. Page 6

football practice as a result."[208] Mr. Collins' letter following the inaugural 1948 race about holding a Peach Parade in lieu of the race to prevent "mass killings" did not happen as such but very well could have. This was the end of road racing at WGI on Mainstreet, but the demand for this type of Grand Prix road racing was high so an interim circuit was explored as efforts were set in motion to acquire space in order to create a purpose-built facility for road racing with topographical features.

2.7.2 THE FIELDS: 1953-1955

There is no polite way to glamorize the interim space, it was a place-holder. The competitions here were unremarkable and will be briefly profiled because races were held and spectators did come to watch. It was unmistakably evident that nothing in the surrounding environment would even remotely replicate or offer the same competitive

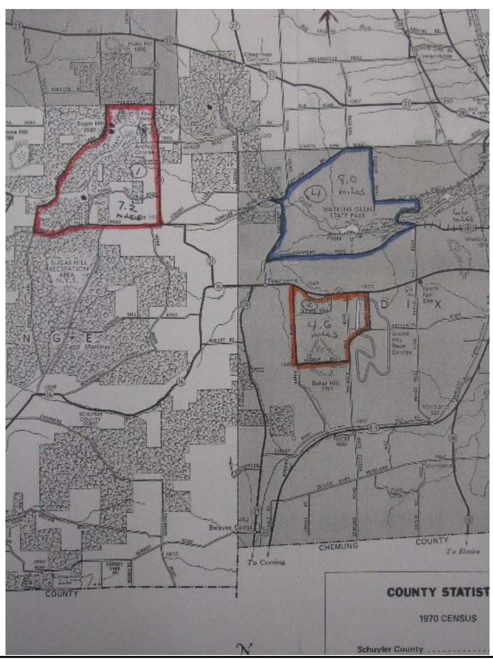

Fig. 2-31: 1970 map showing three options for Interim races '53-'55. The eventual decision went for the space outlined in red on bottom right. Courtesy IMRRC

[208] Scaptura. 4

challenges of the original Mainstreet circuit. With minimal support from municipal and state regulatory agencies due to the 1952 incident, a network of locals and volunteers was cobbled together to assess and decide where to hold the 1953 event.

As the three options were essentially paved farm roads with minimal traffic, the selection was not as cumbersome to manage but still had to meet competitive aspirations in order to entice entrants to return. The final choice of a 4.6-mile course did not disappoint enthusiast participants as by 1955 a flyer announcing the September GP referred to the previous year's success of 223 entries and "nearly 100,000 spectators"[209] Maintaining a professional approach to managing the festive atmosphere, the aforementioned RCA adapted its procedures in order to safeguard, as best as possible, both active and enthusiast participants as shown in the adjacent figure. The most noteworthy matter of historical significance for this dissertation about this interim racetrack was that there were no major issues or problems. However, a pall had been cast over M/S prior to the September 1955 GP because

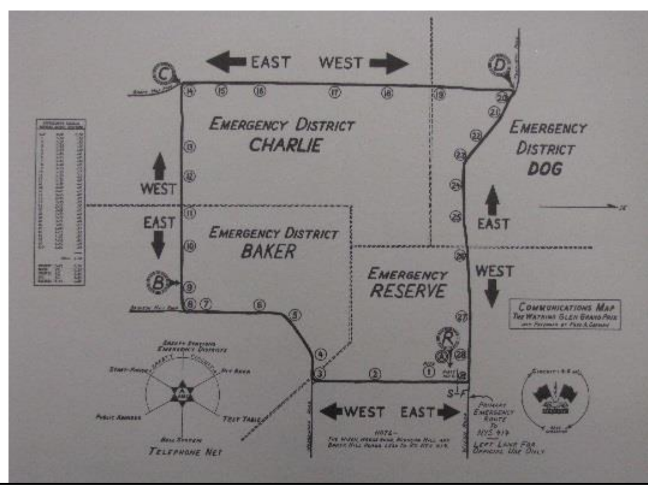

Fig. 2-32: RCA stations and layout for interim track 1953-1955. Courtesy IMRRC.

[209] Jerome Shaughnessy Collection (06A14), IMRRC, Watkins Glen, NY. The drivers however, were not impressed with course from a competitive standpoint which further incentivized the WGGPC to quickly find and build a site.

of the horrendous carnage in June at Le Mans, as described earlier, and the specter of that tragedy loomed large over the WGGPC. In a pre-race memo to RCA personnel, leader Fred German makes it abundantly clear that, in light of the Le Mans tragedy, "The future of this popular sport hangs in the balance. Its very existence depends largely on the adoption of every possible safety measure" and "It is the duty of every RCA member to strive to improve his personal efficiency, thereby improving the efficiency of the entire organization."[210] Without the support and assistance from local and state entities, the task of putting on these spectacles became increasingly strenuous but was endured because it was known that a purpose-built facility would be the only option to retain this annual economic boon so prosperous to local merchants, hoteliers, etc.

2.7.3 THE BUILT: 1956 – 1970s

Fig. 2-33: Photo of RCA members is from mid-1960s but illustrative of professional nature. Courtesy IMRRC. (Jerome Shaughnessy Collection)

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[210] "Memo to Members of the Racing Communications Association – August 26, 1955", Jerome Shaughnessy Collection Supplement, IMRRC, Watkins Glen, NY

According to the blueprint cover sheet, plans were developed in July 1956 for a purpose-built racetrack southwest of the village.[211] Why the plan was not developed earlier for a race date a mere couple of months later, even as just a potential layout, is still unclear to this author and will be shown below to have had a deleterious effect after the first racing weekend.

Cornell University lies a little more than a half hour's drive to the east and that is where Bill Milliken, another founder of road racing at The Glen, worked as an aeronautical engineer. An automotive engineer as well as an enthusiast, it was he who designed the 2.3-mile course along with a team of Cornell engineers. Even though they had never designed or built a racing circuit they proceeded with the thoroughness of their training and profession, in conjunction with their enthusiasm, to even specify minimum requirements

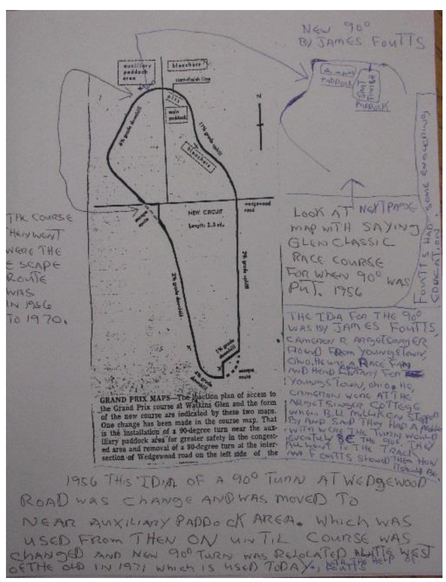


Fig. 2-34: The Built 2.3-mile course layout with percent of grade (notice 11% uphill at The Esses – top right). Hand- written notes of changes are from Bill Green, IMRRC historian, involved with the process. Courtesy IMRRC.

[211] Blueprint: Construction of Watkins Glen International Race Course, 1956. William Green Motor Racing Library, IMRRC, Watkins Glen, NY

for the asphalt paving such as material types and percentages of the final composite which will be re-visited later in this section. It should be apparent, *a priori*, that designing a

Fig. 2-35: RCA plan 1956. Courtesy IMRRC.

competitive racetrack will have had influences from existing world class sites and without empirical evidence to support the statement, the section known as “The Esses” bears a striking resemblance to, if much tamer than, the Eau Rouge segment at Spa-Francorchamps in Belgium – to be discussed in a later chapter. This intentional construction is different from the fortuitousness of the previously mentioned final long curve of the Mainstreet course resembling the built curve at Monza, Italy known as the Parabolica which was a coincidence.

Fig. 2-36: From *Road & Track* December 1955 issue showing installation of timing lights. Courtesy IMRRC.

In addition to a completely new location with continuous intentionally paved surface, new technologies were implemented during construction. The same Fred German responsible

Fig. 2-37: Armco Barrier. Notice the ending of the two white lines on either side of the road surface. Courtesy IMRRC

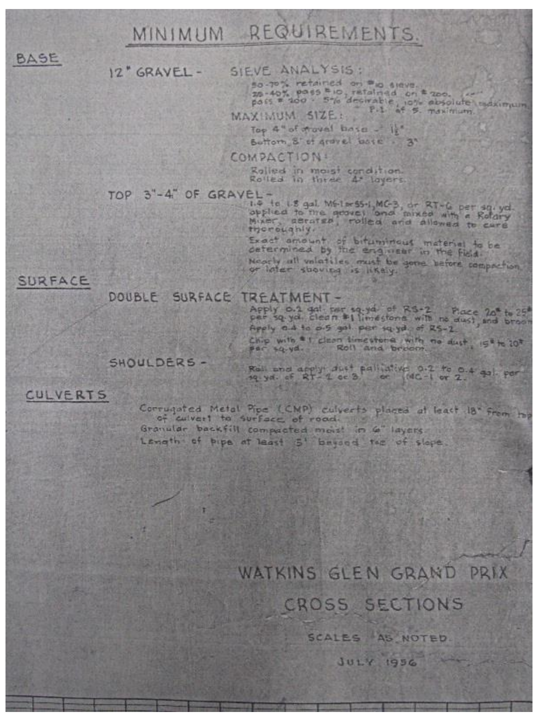
for installing communication lines at the previous two venues was also involved with pre-emptively installing upgraded wire across the entire facility thus enabling simple connections and operational efficiency for the RCA. This was absolutely essential in that cars had become much more powerful and speeds had increased greatly so pre-positioning stations and establishing these land-line conduits with then-modern equipment was an imperative task. Furthermore, timing and scoring technologies had advanced beyond the manual method to an integrated system of timing lights. The purpose was a more effective and efficient manner of capturing car speeds using mini-towers like the one shown here.[212]

There were however, two problematic matters of note, the first of which was seen contemporaneously as a minor issue but which, in later years, became of fundamental concern as vehicles continued to become heavier and much faster year-over-year. Initially

[212] *Road & Track*, December 1955, Miscellaneous Collections, Folder: Road & Track (11A10), IMRRC, Watkins Glen, NY

there were no guardrails presumably to maintain the visual aesthetic of an open road course, but these were added in 1957. However, a section of guardrail on the track which crosses over a support road culvert was initially installed but the end facing the oncoming traffic at full song ended suddenly with a slight "bulbous-ness" which would have resulted in a devastatingly fatal impact. It would, however, be years before guardrail ends were either tapered into the ground, curved away from the track, or buttressed with containers of sand/water.

The second problem was discovered just before practice the day prior to actual racing, verified after the inaugural contest, and had to do with the track surface coming apart.[213] While Milliken and his engineer colleagues were diligent in identifying specific



MINIMUM REQUIREMENTS.

BASE

12" GRAVEL - SIEVE ANALYSIS:
50-70% retained on #10 sieve.
25-40% pass #10, retained on #200.
pass #200 - 5% desirable, 10% absolute maximum
P.I. of 5. maximum.
MAXIMUM SIZE:
Top 4" of gravel base - 1½"
Bottom 8" of gravel base - 3"
COMPACTION:
Rolled in moist condition.
Rolled in three 4" layers.

TOP 3"-4" OF GRAVEL -
1.4 to 1.8 gal. MS-1 or SS-1, MC-3, or RT-6 per sq. yd. applied to the gravel and mixed with a Rotary Mixer, aerated, rolled and allowed to cure thoroughly.
Exact amount of bituminous material to be determined by the engineer in the field.
Nearly all volatiles must be gone before compaction or later shoving is likely.

SURFACE

DOUBLE SURFACE TREATMENT -
Apply 0.2 gal. per sq. yd. of RS-2. Place 20# to 25# per sq. yd. clean #1 limestone with no dust, and broom
Apply 0.4 to 0.5 gal. per sq. yd. of RS-2.
Chip with #1 clean limestone with no dust, 15# to 20# per sq. yd. Roll and broom.

SHOULDERS -
Roll and apply dust palliative 0.2 to 0.4 gal. per sq. yd. of RT-2 or 3 or MC-1 or 2.

CULVERTS

Corrugated Metal Pipe (CMP) culverts placed at least 18" from top of culvert to surface of road.
Granular backfill compacted moist in 6" layers.
Length of pipe at least 5' beyond toe of slope.

WATKINS GLEN GRAND PRIX
CROSS SECTIONS
SCALES AS NOTED.
JULY 1956

Fig. 2-38: Material types and percentages for track surfaces from Blueprints of 1956 construction of WGI. Courtesy IMRRC and Wm. Green Racing Library

[213] This would become a theme with newly built high-speed tracks in the U.S. over the ensuing decade as will be explicated in the next chapter.

requirements for the surface as discussed above, the execution went awry. According to Defecheraux, the summer of 1956 was a wet one delaying any paving efforts such that it was completed only the day before practice thus unable to adequately cure – which is required to properly enable ingredients to set in the same way as concrete, pottery or certain baked goods.[214] However, according to IMRRC Historian and non-voting member of initial founder's group, Bill Green, during the installation of the track surface short-cuts were taken because of the wet conditions.[215] Whether short-cut decision(s) was/were made the General Contractor, Martin & Son from Burdett, NY, or by the paving contractor, Harry J. Suits Central Asphalt from Watkins Glen remains unclear but there were ramifications.[216] Recalling John Fitch's commentary above regarding Lime Rock's racing surface, there is a significant chasm between regular roadway asphalt and the unique amalgamations required to withstand the stresses and forces of high-speed M/S.

While the "Built" was under construction, the SCCA and the WGGPC had been engaged in a tense battle because Argetsinger, et al. wanted to lure the F1 travelling road show, with its drivers paid from various sources, to compete at WGI. The SCCA mandated strictly "amateur", to wit unpaid, even though many were decidedly not amateur drivers. Following the practice session day prior to the actual race day, it became clear that surface degradation had taken place as several active participants complained of being spattered by stones and pebbles from preceding vehicles. In that context, the SCCA issued a two-paragraph mandate to drivers to withdraw from the competition however, after a start line gathering

[214] Defecheraux. 189

[215] Personal conversation with Bill Green at IMRRC. March 2016

[216] "1956 Building of the 2.3 Mile Course" (list of contractors), Book 2, 1956 – [blank], William Green Motor Racing Library.

of the more than 100 drivers where both standpoints were revealed, no driver voted to withdraw.[217] Thus, the inaugural GP race at WGI was a success and lessons learned were immediately remedied, even though similar corrective actions would take 20+ years and draconian measures to admit and implement at European road circuits.

The decade after the first competitive event at the "Built" WGI would see F1 drivers contending for the World Championship as one of the nodes in the F1 network, as well as many other series including WGI into their networks. This level of competition would last for two decades until several factors drove matters toward an uncomfortable detour at WGI and one shared by other venues as will be shown in subsequent chapters.

[217] Defecheraux. Ibid.

CHAPTER III: ON BEING A PARTICIPANT: EARLY 1960S TO EARLY 1980S

Before continuing with the narrative, there is a specific reason for not defining these periods in hard and fast years. In the co-written book *Engineering the Future, Understanding the Past: A Social History of Technology*, the authors discuss the utility of approximations in periodization narratives by indicating, “In the real world, periods overlap and every period is complex and contradictory.”[218] Hughes also states, “The phases in the history of a technological system are not simply sequential; they overlap and backtrack.”[219] So it was in M/S.

This epoch was the most significant and transformational of any for M/S and automobility, thus it requires considerable elucidation. It is therefore separated into two chapters due to the multitude of social, regulatory, cultural, and technological permutations which factored into automobility and M/S evolution, its transformation into a socio-technical system, and how participants experienced M/S. The agents of change included the millions of enthusiasts world-wide and their voices for change.

In this chapter the account will primarily concentrate on what it was like to be an enthusiast participant because they were essential to team revenues from both races and sponsorship

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[218] Erik van der Vleuten et al., *Engineering the Future, Understanding the Past : A Social History of Technology* (Amsterdam: Amsterdam University Press, 2017). Page 18
[219] Thomas P. Hughes, ed. *Evolution of Large Systems*, The Social Construction of Technological Systems (Cambridge: The MIT Press, 1987). Page 56

funding. Without ticket sales organizers would not pay the hosting fees plus without people and companies buying the products of sponsors, there would be no sponsorship deals.

With regard to geo-political and macroeconomic pressures, this period was laden with rancor and tumult. I will briefly acknowledge the most significant issues on matters pertinent to automobility and M/S such the oil crises in the 1970s, the many American laws affecting the design and manufacture of American cars, and the banning of tobacco advertisements. This era was also the beginning of "The Age of Participation" which, as explained by Erik van der Vleuten, ran from 1970 to 2015 whereby he outlines how engineering practice and education shifted from the technocratic science and math based approach to a more holistic process. Incorporated into this notion was how users became more important to design, plus ethics and social aspects also became more imperative.[220]

Over the course of the decades for this chapter the strands of road networks continued extending at an unparalleled rate as did the consideration of design and aesthetics of highways on both sides of the Atlantic for more pleasant driving. One of the more important modes was the resurgence of auto-camping and Recreational Vehicle (RV) travel, especially by M/S enthusiast participants. More notably, the American regulatory maneuvers of the 1960s and 1970s had the intention of improving automobility and the environment but turned out to be technological contradictions of each other in trying to accomplish those goals. This particular chapter explores how enthusiasts manifested their participation, were affected by cultural, regulatory, and production matters, and made accommodations to customize their open-ended artefacts which sat in their driveway. This

[220] Ibid. Chapter

community grew around hundreds of racing series' across the globe with hundreds of thousands of amateur enthusiast drivers in addition to the thousands of active (paid) participant drivers.

3.1 THE MACROVIEW

In the United States, the variety of social disparities led to Congressional intervention and President Lyndon Baines Johnson signing a number of Acts to begin efforts in rectifying those inequalities. However, there was much anger aimed both at the status quo as well as too much change coming too quickly. As evidence, we must simply consider the deadly 1965 Watts Riots in California, the 1968 Hill District riots in Pittsburgh, the 1968 Chicago riots around the Democratic National Convention, and the 1970 Kent State University National Guard shootings that killed four students.[221] According to Dr. Bill Farrar during an interview regarding the Hill District riots, "The former training area of the Pittsburgh Steelers [National Football League professional team] that was outside the window of his living quarters became an Army bivouac site containing armored personnel carriers [M116 APC's] and Jeeps with machine guns, rows of tents, and soldiers as if they were in a battle zone."[222] In addition to those socio-culturally revealing events, there was the *annum horribilis* of 1968 when the country experienced the very targeted anger that resulted in the assassinations of Martin Luther King and Robert F. Kennedy and the violence of the

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[221] Dr. William Farrar, interview by Peter G. Westin, 2010. In the context of full disclosure, following three years being stationed in Germany, my father was transferred to the ROTC department of Duquesne University shortly after those riots. Duquesne is less than two miles from the Hill District. Further, as a contemporary of history, I still lived in Pittsburgh in 1970 which was relatively near the Ohio campus of Kent State and knew of friends who had family attending Kent State as students. It was a troubling time to several of my fellow elementary aged school-kids.

[222] Dr. William Farrar, Ibid. As a former Infantry officer I can state that the machine guns on the APC's would have been heavy-duty .50-caliber in nature while the ones mounted on Jeeps would have been M-60's with projectile measurement of 7.62 mm.

Democratic National Convention in Chicago. This was one of the darkest periods in America's history and people turned to sports as a "get away".

Globally, the Cold War continued by proxy with the Six-Day Arab-Israeli War of 1967 and the follow-on 1973 Yom Kippur War which would have a major effect on M/S and automobility. The other significant event was the growth and establishment of trade unions in early 1980s Poland by Lech Walesa in the form of *Solidarność* (Solidarity). This was a sea-change in global ideological topography in that it occurred in a communist country which had not previously allowed any dissenting organizations and one of the few positive events from this epoch. This would have a M/S connection in subsequent years.

In previous paragraphs I have indicated there were two matters which directly affected active and enthusiast participants of M/S. The first was the oil crises of 1973 and 1979, and the second being the banishment of tobacco ads on media platforms. This document will discuss these two events in reverse order.

3.2 NICOTIANA TABACUM

This is the botanical name for the tobacco species that is "the world's most important material used for smoking"[223] During the middle decades of the 20th century, the end product of this leafy substance was very widely used in the form of cigarettes. Adults smoked in offices, movie theaters, sports venues, and any number of close-quarter environments. Teenagers would sneak a "smoke" hoping to not be caught by the parents thinking they had "grown up". Smoking was a ubiquitous activity generating massive

[223] "Nicotiana Tabacum," in *The New Encyclopeadia Britannica*, ed. Phillip Goetz (Chicago: The University of Chicago, 1988). Volume 13, page 779-1b.

profits for tobacco companies. Concomitantly, research into health dangers of tobacco had been ramping up eventually resulting in the banishment of any ads in the media for tobacco products. Regulatory action began in the United Kingdom with the 1964 Television Act, continued with the American Public Health Cigarette Smoking Act of 1970, the subsequent EU directives against cigarette advertising during the 1980s, and Canadian laws starting in 1988. Why does this matter to M/S? Without tobacco funds, R&D would not have grown.

When government regulations withdrew the avenue of tobacco advertising in any media during the 60s and 70s, it resulted in massive ad budgets – many billions of dollars – with nowhere to channel it thus considerable concern about how to spend the allocated funds. In this atmosphere M/S was an openly willing recipient of this cache of yet-to-be-committed fiscal windfall. Racing was becoming expensive and the tension to remain competitive was enormous for active participants so the diversion of tobacco money into their sport was a relief valve for that mounting pressure. Thus began the marketing segment known as corporate sponsorship of M/S in earnest with major company names.

It is without question that some limited forms of sponsorship, beyond factory support for some teams, actually began in the 1950s with oil companies Esso (American and now known as ExxonMobil in the U.S. but remains as Esso in Europe) and the French oil company Elf funding F1 teams plus the American poultry firm Holly Farms funding NASCAR's Junior Johnson single car team starting in 1961. However, as racing technology delivered greater speeds and control across the 1960s, it also delivered invoices with bottom lines that grew exponentially. Race wins came at a high cost and tobacco companies needed outlets for their "ad-spend".

The F1 Lotus team owner Colin Campbell needed to find a replacement sponsor after the rule changes for engines prior to the 1967 season caused Esso to indicate F1 had become "too rich for its blood." He lamented, "We have rockets and supersonic aeroplanes, so we can't expect racing cars to be produced for the same cost as they were even ten years ago. In order to maintain station in this technological age we need to produce sophisticated machinery. All this costs money."[224] To accomplish this financial replacement he began negotiating with Gold Leaf Tobacco for the 1968 season which coincided with the FIA removing restrictions on sponsorship effective that year. In 1972 Team Lotus was sponsored by a larger British tobacco company, John Player Special, with that relationship continuing for another decade which included a driver's world championship for the iconic American Mario Andretti.

For Mr. Johnson above, a winning driver and car builder/mechanic in NASCAR, the tipping point occurred by early 1970 in that "the sport had gotten 'just too expensive' since the Detroit factories had withdrawn".[225] The solution for him was a "short trip down Highway 421…to the Winston-Salem [NC] headquarters of R.J.Reynolds Tobacco" that same year[226]. However, RJR was looking for a much larger platform for its hundreds-of-millions of dollars, which he soon realized was beyond him so he passed the company's representatives on to Bill France to negotiate for the entire NASCAR umbrella. A deal was reached in December 1970 whereby RJR would initially fund the race purses for three individual races as well as the season points leaders fund for 1971 and starting with 1972 would sponsor the entire season which resulted in the top tier series being named the

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224 Ludvigsen. Page 370
225 Pierce. Page 288. A successful NASCAR team cost 50 – 75 thousand dollars to operate at that time.
226 Ibid.

NASCAR Winston Cup until 2004.[227] Unlike sponsorship at F1 and WEC venues, RJR created a Special Events Operation that "financed building projects to upgrade facilities at many local tracks" as well as helping "team owners find corporate sponsors for their cars."[228] The proliferation of tobacco sponsorship by all tobacco companies worldwide was a windfall for M/S in general and F1 in particular, more on this further below in the section about Bernie Ecclestone.

3.3 CRISES, REGULATIONS, and CONTRADICTIONS

This period saw the beginning of the aforementioned "Age of Participation" phrase coined by Van der Vleuten, et al. and which was highly relevant as it affected outcomes on many fronts impacting M/S participants. During this span, there were three strategies employed to open technocratic systems and bureaucracies to increased participation by the populace with regard to policy decision-making. Intentionally reversing the order of these strategies from the original van der Vleuten manuscript, there was delegation whereby, "government is best when delegating responsibilities to society, which includes private enterprise, citizens, and civil-society organizations."[229] Next was mediation which is defined as, "professional mediators invite representatives of each stakeholder group to debate important new technologies."[230] Participation by protest was the eponymous approach that "could lead to adapting technological solutions – without having to give up technology altogether."[231] Regarding environmental issues of this period, we know mediation seldom succeeded, and we know from the case of Friends of the Earth (FOE), among others, that

[227] RJR and NASCAR eventually parted ways for the same reason as tobacco from F1 - see Chapter 5.
[228] Pierce. Page 289
[229] Van der Vleuten et al. Page 140
[230] Ibid. Page 139
[231] Ibid. Page 136

efforts through delegation usually came up empty.[232] However, it was through the acts of protest that people affected change in environmental policy in matters such as those discussed later in this chapter. Van der Vleuten concludes that the method of protest was the most effective as was the case for M/S in later decades.

In Frank Ükötter's edited compendium *Turning Points in Environmental History,* the focus is on explaining critical pivot points in environmental history. Of significant note here is the preponderance of narratives which indicate the early 1970s as a major turning point.[233] I present this in this chapter in order to provide a backdrop for the ensuing conversation which, at its foundation, is the contested notion of determining how "nature" and "natural" are to be defined. Since this dissertation deals with the built space of racetracks, highways, and the landscape in which they are situated it would be a mistake to not address the matter. The dilemma, however, is that leading intellectuals in this field of study are resolute in their rejection of an absolute definition. William Cronon shares "that 'nature' is not nearly so natural as it seems"[234] Richard White contributes how "the made world and unmade world…have begun to merge and blur"[235] The eminent German historian Joachim Radkau further adds that "'Nature' as a guiding model has multiple meanings and can never be completely attached to a single conception or a specific technology."[236] This tension played out during M/S circuit construction.

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232 Jennifer Thomson, "Surviving the 1970s: The Case of Friends of the Earth," *Environmental History* 22, no. 2 (2017).
233 Uekötter.
234 William Cronon, "Beginnings: Introduction, in Search of Nature," in *Uncommon Ground,* ed. William Cronon (New York: W.W. Norton & Company, 1996). Page 25
235 Richard White, "Toward a Conclusion," ibid. page 457
236 Radkau. Page 302

Another confounding factor to the environmental element of this story was the transnational aspect as gases, pollution, and other effects carried across mapped boundaries with impunity.[237] This was particularly substantive as it pertains to Europe and enthusiast participant sentiments merging in their concerns. Although people and social movements in America were beginning to add their voices to automotive impacts on the environment, there was greater rancor in the late 1960s and early 1970s over noise pollution and ozone depletion as a result of the proposed Super Sonic Transport (SST) to the extent that the "Coalition Against the SST, or CASST" was an organization which grew to more than 40-million members.[238] In concert with the international effect of the SST, J.R. McNeill and Corinna Unger present: "The environment is a trinational actor and setting *per se*, transcending all political and cultural borders…"[239] To bolster this sentiment Richard White further adds in referring to an idea by Ian Tyrell, "that certain problems and historical developments demand a unit of analysis other than the nation state."[240] The normal regional quandary, however, had been getting all nation-states to arrive at a consensus toward pollution control, but successful compromise is indeed outlined in a 2004 UNECE publication that "Over the past quarter century the politics of Europe has changed. These changes have not altered the political willingness of member states to work together under the Convention."[241]

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[237] On transnational history see: Bayly. As well as: Turchetti. Additionally see: van der Vleuten.

[238] Subcommitee of the Committee on Appropriations, *Civil Supersonic Aircraft Development (Sst)*, 1st session, March 1-3 1971. U.S. Congress, Pages 31 – 417, Jimmy Carter Presidential Library, Atlanta, GA.

[239] JR McNeill, Unger, Corinna, "Introduction: The Big Picture," in *Environmental Histories of the Cold War*, ed. JR McNeill, Unger, Corinna (Cambridge: Cambridge University Press, 2013). Page 15

[240] Richard White, "The Nationalization of Nature," *Journal of American History* December (1999). Page 981

[241] J. Sliggers, Kakebeeke, W., ed. *Clearing the Air: 25 Years of the Convention on Long-Range Transboundry Air Pollution* (Geneva: United Nations, 2004). UNECE is United Nations Economic Commission for Europe.

Tying this all together at the intersection of automobility, history of technology, and environmental history we have further informed perspectives. From Stine and Tarr, they indicate that, “More than any other survey published to date [Carroll Pursell’s] treatment stands as a model”, in discussing “the impact of automobility on the nation’s cities and countryside and the challenges of the post-1960s environmental movement.”[242] In explicating the conflict between technology and national ideological environmental vacuums, Ükötter writes: “The environmental boom of the 1970s had been mainly an American affair, with the rest of the world following up in often lukewarm fashion.”[243] Finally, James Williams tells us in the *Illusory Boundary* that “TPH posits that much of the world ‘consists of intersecting and overlapping natural and human-built systems, which together constitute *ecotechnological* systems,’ which humankind has created in concert with nature.”[244] It is imperative that these complicated environmental relationships remain front-of-mind over the course of this narrative because the M/S circuits enumerated in this monograph do indeed overlap natural and human-built systems resulting in large eco-technical systems in which the competitions are reliant upon pollutants derived from oil. As will be seen later chapters this matter will have an impact on M/S.

The two oil crises of the 1970s were thorny factors for both automobility and M/S. Beginning with the latter, there was surprisingly little impact on active participants. Some

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[242] Jeffrey Stine, Tarr, Joel, "At the Intersection of Histories: Technology and the Environment," *Technology and Culture* 39, no. 4 (Oct.) (1998). Page 612. For Pursell’s elucidation see: Carroll Pursell, *The Machine in America: A Social History of America* (Baltimore: Johns Hopkins University Press, 1995, 2007). Chapters 12 and 13.

[243] Frank Uekötter, "The End of the Cold War," in *Environmental Histories of the Cold War*, ed. JR. McNeil, Unger, C. (Cambridge: Cambridge University Press, 2013). Page 344

[244] James Williams, "Understanding the Place of Humans in Nature," in *Illusory Boundary: Environment and Technology in History*, ed. M. Reuss, Cutcliffe, S. (Chartlottesville: University of Virginia Press, 2010). Page 17 – emphasis added by Williams.

NASCAR races were temporarily reduced from 500 miles to 400 in 1973/1974 and some practice sessions were eliminated. The broader impact was on the enthusiast participants as discussed in a 1973 New York Times article, “Empty Seats, Not Tanks, the Issue In Fuel Crisis” where the author discusses how enthusiasts could not travel great distances in order to watch the competitions in-person[245]. They also could not take part in the ancillary rituals of camping, infield food events, sharing grilling ideas, live musical performances, etc. all of which augmented their experiences.

In Europe, the fuel shortages and concomitant recessions similarly effected enthusiast participation at the contests yet had a minimal impact on the active participants or the actual racing. That said, perception of M/S as wasteful of gasoline was rampant – even though most teams were using their own concoctions as there were neither regulated specifications for fuel mixtures, nor established standards. As former Lotus Chief Engineer and current FIA Technical Consultant Peter Wright wrote, “When fuel chemistry was free, combustion problems could be solved by various ‘rocket fuel’ recipes, brewed by the chemists.”[246] Indeed this did little to uncomplicate the relationship between M/S, its various participants, and the general public with regard to fuel consumption but people continued to attend auto racing events.

When it came to automobility, primarily in the United States, however, this era saw “a convergence of: 1) external influencers such as the OPEC oil “embargo” (paper tiger that it was as is outlined below); 2) frequent economic hardship from recessions; 3) paradigm-

245 Michael Katz, "Empty Seats, Not Tanks, the Issue in Fuel Crisis," *New York Times*, 18 November 1973 1973. P 243

246 Wright. Page 66

shattering (and necessary) legislative enactments; 4) an abysmal lack of sensible corporate guidance and appropriate decision-making; and 5) inadequate execution or poor operational implementation"[247] In the first half of the 60s decade, there was a spate of legislative enactions in the United States regarding both pollution from, and safety of, the automobile whereby they were to take effect starting in the late 60s. These included the 1960 Schenck Act (clean air), 1963 Clean Air Act, 1965 Motor Vehicle Air Pollution Control Act, 1966 National Traffic and Motor Safety Act. Intermingled with these federal mandates were a plethora of state actions resulting in considerable confusion of which standards took precedence.[248] Once the decade changed over to the 1970s, there were almost annual updates, replacements, and superseding regulatory actions carrying on into the 1980s further guaranteeing the "miasma that was the 1970s through 1980s auto industry."[249] To be briefly outlined below, the technology of the time could not adequately cope with the requirements that put clean air technology in contravention to the physics of automotive engineering. Or as Rudi Volti indicates, "In all fairness to the domestic automobile manufacturers, it has to be said that reducing automotive emissions is a difficult task."[250]

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[247] Peter Westin, "From Beauty to Beastly: The Lost Years of the American Automotive Industry, 1973 - 1985," (Georgia Institute of Technology, 2010). Page 22

[248] Jack Doyle, *Taken for a Ride : Detroit's Big Three and the Politics of Pollution* (New York: Four Walls Eight Windows, 2000). Pages 509-510

[249] Ibid, page 3

[250] Volti. Page 121

As it relates to air pollution during this phase, there was one invention which had massively significant repercussions – the catalytic converter. But as David Edgerton informs about invention origins in *Shock of the Old*, this invention can actually be traced back a quarter century when French chemist, WW I *Croix de Guerre* recipient, and racing enthusiast, Eugene Houdry discovered in April 1927 how to 'crack' petroleum to get higher octane ratings which would prevent the technical problem of engine 'knock'.[251] This knock was the result of car makers trying to squeeze more power out of engines due to market demand. A more cost-effective method, it was nonetheless too late and, as an example of David Nye's notion of "soft-determinism", Charles Kettering's group's solution at General Motors for greater power was accepted by adding one part tetraethyl lead (TEL) to 1300 parts gasoline.[252] Because Houdry's system was only fully developed three years after implementation of TEL it would have been too expensive to convert, and TEL became the preferred method.

Fig. 3-1: Eugene Houdry. Source: Google Images

[251] Edgerton. Houdry also owned and drove a Bugatti.
[252] On "soft determinism" see David Nye, *Technology Matters: Questions to Live With* (Cambridge: The MIT Press, 2007). Page 55. For a parallel notion called "Collingridge Dilemma" see Vleuten et al. 17, On TEL, see McCarthy. Page 48.

Fast forward to 1948 when Dutch scientist Dr. Arie Haagen Smit at California Institute of Technology discovered that the cause of smog over Los Angeles, was a toxic combination of the sun's ultraviolet radiation, NO_2, O_3, peroxyacyl nitrates, with particulates of carbon, CO, CO_2, and SO_2.[253] Returning to Mr. Houdry, his catalysis process led to high-octane aviation fuel and synthetic rubber in WW II and he also invented a method to extract hydrocarbons. The downside of the catalytic converter was that it required expensive platinum and would clog to only 22% effectiveness after only 4,000 miles and that unleaded gasoline was scarce at that time.[254] A detailed account of the furtherance of catalytic converters is out of scope for this narrative but it is important to add that Houdry's invention eventually became what is now underneath every car today. However, during the second half of this era, the science created an unforeseen consequence for American military personnel stationed in Europe. As will be explored in the next chapter, it was not until the mid-1980s that unleaded gasoline was mandated, at various times, throughout that continent.

Central to the account of legislative regulation was the year 1973 as it was what I call "a year of anger" for all levels of participants with: the Vietnam War drawing to a close as aggressive opposition grew at home, the Yom Kippur War between Israel and Arab nations which resulted in the Organization of Petroleum Exporting Countries (OPEC) imposing an embargo on oil shipments to allies of Israel, the Watergate scandal involving sitting American president Richard Nixon that resulted in his resignation from office, beginning of sharp recession on both sides of the Atlantic impacting family consumption decisions

[253] Volti. pp 119-120
[254] McCarthy. Page 127

along with “stagflation” which was a toxic economic condition of stagnant economic growth, high inflation, and high unemployment, as well as so much socio-economic and cultural upheaval and uncertainty.[255] Regarding automobility, American legislators and citizens were both angry at car companies for not caring about the consumer and either ignoring or obfuscating their desires and safety requirements to protect the very people who bought their products.[256] People would have been angrier still if it had been more broadly known at the time, that the oil embargo “was something of a paper tiger with as many as [700,000] barrels of Arab oil a day ‘leaking’ into the United States” and that American oil supplies never really dipped.[257] However, perception became reality in terms of American car manufacturers precipitating a dizzying sequence of regulatory mis-steps in conjunction with poor decisions within the auto industry itself.

Fig. 3-2 (a) and (b): Same company, same name, same year. On left is 1974 Ford Granada in America. My wife’s first car. Note bumper and bluntness of boxy design. On right is 1974 Ford Granada in Europe. Note sleek, more aerodynamic design line Courtesy Google Images

[255] Keith Crain, ed. *America at the Wheel: 100 Years of the Automobile in America* (Detroit: Crain Communications, 1993). Stephen W. Sears, *The American Heritage History of the Automobile in America* (New York: American Heritage Pub. Co. : book trade distribution by Simon and Schuster, 1977). Lillian Breslow Rubin, *Worlds of Pain: Life in the Working Class Family* (New York: Basic Books, Inc., 1976).
[256] Westin, "From Beauty to Beastly: The Lost Years of the American Automotive Industry, 1973 - 1985." “Beauty to Beastly
[257] Sears. Page 352

It is in the context of the narrative immediately above and below to thoughtfully consider the prescient words of Ralph Nader in 1965 that, “A great problem of contemporary life is how to control the power of economic interests which ignore the harmful effects of their applied science and technology.”[258] The model year 1974 was the year that two federal mandates took effect, the 5-mph bumper and the national 55-mph speed limit, with disastrous, if not debilitating, consequences for car makers and owners. In the early 1970s of automotive Americana, engine power, often using the colloquial term ‘muscle’, was still the dominant preference. The excess of engine size and horsepower led conversations as some speedometers visually represented this aspect by showing maximum speed of an astonishing 140-mph.[259] However, many Japanese and European imports were gaining market share for their fuel efficiency compared to “Detroit Iron” as it was termed by enthusiasts. Development of those smaller cars and engines – thus lower fuel consumption – was based on the various countries’ high property tax rates on automobiles and tighter

Fig. 3-3: 1972 Pontiac Luxury LeMans GT like my first car with a 140-mph speedometer. Courtesy www.gateways.com

258 Ralph Nader, *Unsafe at Any Speed: The Designed-in Dangers of the American Automobile* (New York: Grossman Publishers, 1965). Page ix

259 My first car (in 1978) was a 1972 Pontiac Luxury LeMans GT with a 140-mph representation on the dashboard.

urban spaces, which were not factors in the United States. Among the most impactful import was the BMW 2002tii manufactured in Germany from 1966-1977 “which was a solid performance car that achieved +/- 25-mpg with high product quality and it was this car that permanently put the BMW marque on the map in the United States.”[260] Related to the issue of taxes, high taxes on gasoline at the pump meant that the price for a measurement of fuel (whether imperial gallon or standard liter) in Europe was higher than in America by as much as a four-fold factor.[261] In contrast, people who lived and drove in the geographic space between Canada and Mexico could afford large cars with powerful engines and they had become comfortably accustomed to this luxury of cheap fuel.[262] Indeed, American manufacturer’s production of large, powerful cars was a scenario of essentially living on borrowed time as historian Stephen Sears notes, “The year 1973 will be remembered as the beginning of the end for the big car in America.”[263]

In order to bring a new car to market from concept, through design, technical evaluation, pre-production review, final approval, and, finally, production, took about four to six years. Thus the 1970 Clean Air Act had a deadline of the model year 1975-1976 and in this federal mandate was included the requirement of “a 90% reduction in carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_2)”.[264] The problem, however, is that conventional engines permit “very little time to combust the air-fuel mixture” resulting in some

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[260] Westin, "From Beauty to Beastly: The Lost Years of the American Automotive Industry, 1973 - 1985." “Beauty to Beastly”, pages 17-18
[261] Laux. Taxes on cars were based on horsepower. This process traced back to 1898 France “taxing anything that moves” and “(In France horsepower is *cheval vapeur*, abbreviated CV)”. Page 11
[262] Robert A. Lutz, *Car Guys Vs. Bean Counters : The Battle for the Soul of American Business* (New York: Portfolio/Penguin, 2011). Page 24
[263] Sears. Page 325
[264] ibid. Page 318

“unburned hydrocarbons” inevitably escaping.[265] These are released through the car’s tailpipe unless there is a catalytic converter attached. However, lowering HC’s will increase NO_2 emissions and conversely, lowering NO_2 will increase HC’s.[266] The science and technology of materiel and chemical compounds of the time, “meant that to control emissions would mean being pulled in diametrically opposite technical directions and would: A) <u>decrease</u> performance, B) <u>increase</u> fuel consumption, and C) <u>increase</u> problems of run-ability.”[267]

Fig. 3-4: My second car, a 1978 Buick Regal with huge bumpers, small engine, weighing two tons. Courtesy Google Images

Further magnifying the dilemma were the two federal mandates mentioned above. The addition of a 5-mph bumper meant a combined 500-600 pounds (approximately) to the car’s total weight. This had a direct impact on NASCAR racing as they were still using actual stock car bodies which looked like the boxy new ones the enthusiast participants drove to the event. Regardless, these were appalling from a design perspective and served as a blunt frontal space and a decidedly non-aerodynamic effect.

One factor affecting the approach to designing American cars was the change in power away from the creative element and re-centered in the business operations or, as in the

265 Volti. Page 121
266 ibid.
267 Westin, "From Beauty to Beastly: The Lost Years of the American Automotive Industry, 1973 - 1985." “Beauty to Beastly”, page 9

words of Bob Lutz (former senior executive at BMW, Chrysler, Ford, and General Motors), "Design would no longer originate a product…From now on, products would be initiated by Product Planning (a department composed of recycled finance types)"[268] The end result can be examined in the comments from those entrusted with a car's outward appearance. One designer bitterly recalled how, "Car design came to a screaming halt in 1973, and it stopped for a decade…"[269] Another, GM Chief Designer Ron Hill, revealed in a later interview that, "We had to respond to it. The bumper laws became paramount. You had to design your cars around bumpers."[270] Still another described the decade as an "aesthetic malaise" and yet another calling the "period of design after 1973 [as] 'sleepwalking'"[271]

The final important piece in this complicated puzzle was the mandate by President Richard M. Nixon's signature approving the national 55-mph speed limit. The correlation to automobility and M/S can be found in its combination with all of the problems above in conjunction with the application of the catalytic converter. The precise mixture of fuel and air in the internal combination engine is very much like the formulaic process of baking – any change to any ingredient will change the end result in a negative manner. The newly mandated Exhaust Gas Recirculating (EGR) valve and Positive Crankcase Ventilation (PCV) valve that diluted engine air flow, the catalytic converter that was a blocking device to efficient exhaust airflow, the added weight of 500 pounds of bumper as a blunt wall that reduced aerodynamic flow, and the reduced quality of gasoline at the pumps, all mixed in a cauldron of failed first iterations of new technologies. These included clogged convertors

268 Lutz. Page 17.

269 David Gartman, *Auto Opium : A Social History of American Automobile Design* (London ; New York: Routledge, 1994). Page 214.

270 Armi. Page 96. The picture of 1978 Buick Regal is my second car which had a small V6 engine yet weighed almost two tons and was almost 20 feet in length.

271 Ibid. Page 97 both quotes.

and injectors, carburetor fuel foaming, fuel delivery system vapor lock, vacuum problems, and trips that took more time. The compendium of these issues contributed to heightened levels of discontent and outrage by many and especially by the M/S enthusiast participants.[272]

Enthusiast participants were highly loyal to specific marques thus the process of producing street cars is quite germane to this narrative because, as one academic journal article quotes Amy Baldwin from the *Dayton Daily News*, "72% of NASCAR fans almost always or frequently buy brands that sponsor over ones that don't"[273] This assertion is not a point of controversy as NASCAR fan loyalty to brands, especially to car manufacturers, is unquestioned in academic literature.[274] Throughout the 50s, 60s, and 70s, the Detroit mantra, once it accepted NASCAR as important, regarding safer cars was that that "safety doesn't sell" and the strong enthusiast car maker loyalty mentioned above bore out this perception mainly because safety add-ons incurred an extra cost and the addition of seat belts, padded dash console, sun visors, safety door latches, *ad inf*. <u>did not sell</u> in high enough volumes required to offset the cost of production.[275]

Furthermore, changes in labor requirements as well as changes in the process for producing cars was at issue in the 1970s. The United Auto Workers (UAW) was an extremely

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[272] James K. Wagner, ed. *The Automobile : A Century of Progress* (Warrendale: Society of Automotive Engineers (SAE), Inc., 1997).

[273] S. Pruitt, Cornwell, T., Clark, J, "The Nascar Phenomenon: Auto Racing Sponsorships and Shareholder Wealth," *Journal of Advertising Research*, no. September (2004).

[274] Among the literature includes: J. Cobbs, Hylton, M., "Facilitating Sponsorship Channels in the Business Model of Motorsports," *Journal of Marketing Channels* 19, no. 3 (2012). See also: K. Rotthoff, Depken, C., Groothius, P., "Influences on Sponsorship Deals in Nascar: Indirect Evidence from Time on Camera," *Applied Economics* 46, no. 19 (2014); H. A. Branham, *Bill France Jr. : The Man Who Made Nascar* (Chicago, Ill.: Triumph, 2010).

[275] Crain. Page 158; as well as Joel W. Eastman, *Styling Vs. Safety : The American Automobile Industry and the Development of Automotive Safety, 1900-1966* (Lanham: University Press of America, 1984). Page 232

powerful and highly contested entity of this era in America and paralleled contemporary movements in British, French, and Italian labor organizations for automotive assembly workers.[276] The most notable example of this tension was at the General Motors Lordstown, Ohio plant which experienced wholesale changes in manufacturing methods for the Chevrolet (Chevy) Vega small car that brought in robotic movements that were the precursors to current day 7-axis mechatronic machines.[277] The increased pace of production, poor design, and hastened engineering resulted in a “euphemistically ‘built’ and uninspired car that was a ‘lemon’ ‘with…design faults that required three major safety recalls from corner-cutting production errors’”[278] There was an attempt to entice the M/S enthusiast consumer with a Chevy Cosworth Vega with a street-legal version of the F1 engine but only 5,000 were built and they were hand-built.

At another manufacturing company, Chrysler, circumstances were much grimmer. It took several years from the 1973 OPEC oil embargo to the 1979 memoranda to President Jimmy Carter’s Council of Economic Advisers (CEA) which relayed Chrysler’s fiscal dilemma.[279] In the intervening years there were two distinct recessions in conjunction with two OPEC oil embargoes. Further, Chrysler mis-timed the market so it was late to adapting to smaller engines and the smaller car concept plus the American public was unhappy because “The US consumers had been on the hook over the four other large-scale bailouts which were

[276] Patrick Fridenson, "Fordism and Quality: The French Case, 1919-93," in *Fordism Transformed: The Development of Production Methods in the Automobile Industry*, ed. H. Shiomi, Wada, K. (Oxford: Oxford University Press, 1995). As well as Stefano Musso, "Production Methods and Industrial Relations at Fiat (1930-90)," ibid. In addition see Stephen. It is notable that West German car makers did not have this problem as examined in Abelshauser. See also, Noble.
[277] On “mechatronics”, see Mowery. Page 213
[278] Westin, "From Beauty to Beastly: The Lost Years of the American Automotive Industry, 1973 - 1985." Beauty to Beastly, page 20. Quote from: Sears. Page 325.
[279] R. Schlosstein, 11 July 1978 1978. “American Motors Corporation” folder, Box 103, Staff Offices – Domestic Policy Staff, Eizenstat, Jimmy Carter Presidential Library, Atlanta, GA

(in 2008 dollars) the Penn Central Railroad – 1970 ($3.2 billion), Lockheed – 1971 ($1.4 billion), Franklin National Bank – 1974 ($7.8 billion), and New York City – 1975 ($9.4 billion) so the…($4.0 billion) was indeed a bitter pill to swallow."[280] In an attempt to lure and/or save area jobs, there were several localities that tried to fiscally "prop up" Chrysler by offering various forms of financial assistance.[281] In the end, Chrysler was bailed out with HR Bill 5860 (now known as Public Law 96-185) on January 7, 1980.[282] But this did nothing to assuage the palpable sense of dismay at, and distrust of, the Detroit "machine" that was American auto manufacturing, indeed it only served to exacerbate the prevailing sentiments. All the more reason for "car-people" to escape daily life through intentional leisure like working on their car, watching races, or going to races. Having just vilified the American car design industry since 1973, I offset this with the fact that well designed cars did exist from the early 1960s to the early 1970s such as the Ford Mustang, the Chevrolet Camaro, among others. In this context I return to the familiar name of Raymond Loewy and his Studebaker Avanti.

His *in tempus* radical notions were too advanced for Detroit producers to risk implementing as it would have changed how America's firms designed cars – and he was a Frenchman thus an outsider. As a reminder, Loewy advocated light weight yet strong materials, reasonable luxury appointments, appealing visual lines, and, most importantly, the

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280 Peter Westin, "Chrysler 1979: The Birthing of a Bailout," History, Technology, and Society (Atlanta: Georgia Institute of technology, 2010). Page 3 Course paper for HTS 7001. See also, Louis Galambos and Joseph A. Pratt, *The Rise of the Corporate Commonwealth : U.S. Business and Public Policy in the Twentieth Century* (New York: Basic Books, 1988). Chapter 11, "The World According to Iacocca"

281 Town of Seneca Falls, 9 August 1979. Letter to President Carter, Chrysler folder, Box 31, Carter Presidential Papers – Staff Offices: Cabinet Secretary and Intergovernmental Affairs, Jimmy Carter Presidential Library, Atlanta.

282 Torres, "Signing Ceremony for H.R. 5860, the Chrysler Loan," news release, 7 January 1980. Chrysler folder, Box 15, Staff Offices, Special Assistant to the President – Torres, Jimmy Carter Presidential Library, Atlanta, GA.

Fig. 3-5: Raymond Loewy's Studebaker Avanti profiled in 1962 article in *CARS*. Image courtesy Hagley Museum & Library

inclusion of safety features. We learned above that executives in the American auto manufacturing corporations had bottom-line myopia with regard to safety. Nonetheless, Loewy propagated his perspective that safety did matter **AND** it could simultaneously look really nice. As Petroski informs, "Loewy was an observer not only of society but also of its products."[283] From a principled standpoint he was vindicated in 1962 by automotive publications such as *CARS* magazine in an article titled, "Studebaker's Avanti – Another Loewy Classic"[284] and separately in *Car* magazine article of the same year titled, "Engineered Luxury Makes Safer Car."[285] Even the automotive industry manager for United States Steel (USS) complimented him in 1962 of a car that is, "definitely

[283] Henry Petroski, *The Evolution of Useful Things: How Everyday Artifacts - from Forks and Pins to Paper Clips and Zippers - Came to Be as They Are* (New York: Vintage Books - A Division of Random House, Inc., 1994). Page 176
[284] Raymond Loewy Archive, Scrapbook 1, Page 13B, Accession 2251, Hagley Museum & Library, Wilmington, DE 19807
[285] Ibid. page 33A

aerodynamic and yet retains a crispness that is visually pleasing."[286] In Europe, the headlines were effusive. From the 1962 Christmas special edition of *Beaux Arts* in Brussels in advance of the 1963 Brussels Auto Show to the February 1963 *l'Equipe* headline "*La Studebaker Avanti (200 KM.-H): Une Grande Tourisme Made in U.S.A…*" and the Paris Presse, "*Depuis dix ans, on ne voulait plus de ses voitures: trop radicales – La grande revanche de Raymond Loewy"*[287]The unfortunate element of Avanti and the Studebaker corporation overall was the albatross of production mistakes in 1953 that could not be expunged and which culminated in the financial drowning of the Indiana company. On the Sunday morning of March 6, 1966, the South Bend Tribune announced the closure of the Studebaker Car Company after 114 years.

3.4 LEISURE AND GETTING THERE

Before delving into automobility and infrastructure, it is necessary to briefly examine the late 20th century growth of the activity known as leisure because while M/S is a business, it is also entertainment thus a leisure activity for enthusiast participants. As background, Stefan Poser initially shares how, "Jürgen Habermas argued in 1971 that the concept of leisure has only secondary import '*in einer Gesellschaft, deren zentrale Kategorie immer noch die Arbeit ist*'"[288] Then, he immediately places this into context that the meaning of work has a different emphasis in current understanding and circumstances. According to Poser, research in late 19th-century primarily viewed sport as <u>the</u> means of recuperation

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[286] Ibid. page 28. Letter from John Reinhart (USS) to Raymond Loewy, May 1, 1962
[287] Raymond Loewy Archive, Scrapbook 38, Page 13, 29, and 22 respectively, Accession 2251, Hagley Museum & Library, Wilmington, DE 19807. Translation by this author of the latter is "Over the past ten years his cars were not desired – the great revenge of Raymond Loewy"
[288] Poser.Webpage 4, Accessed 12/3/15 Translation by Poser, "in a society whose central category is still work"

from work and one example was the formation of football teams (a.k.a. soccer in the United States) in large European cities, some of which became major globally recognized names such England's Liverpool (1892), Germany's Bayern München (1900), France's Lyon (1893), Spain's Barcelona (1900) to name but a few.[289] While other organized efforts at leisure also existed in Western Europe during this period, America was also experiencing sports oriented leisure primarily with stick and ball sports at local venues.[290] Furthermore, National Parks were established so people could drive and gain a new experience because they had newfound mobility with the ubiquitousness of the Ford Model-T.[291] Although seemingly mitigated by the Great Depression, there was actually a growth of individual work on personal cars by Americans which carried through the Interbellum thus enabling some families to occasionally escape the day-to-day unpleasantness of the time.[292]

Arnulf Grübler contributed his monograph *Technology and Global Change* to further explicate this 20th-century expansion of deliberate leisure time which, herein, will be oriented toward a relationship with automobility and M/S. People lived longer, brought home higher wages, and spent less hours at their place of work. Thus, in conjunction with social changes and productivity gains, "an industrial worker in the USA today produces in one hour what took an English laborer two weeks of toiling 12 hours per day some 200 years ago."[293] The technological advances of the latter half of 1900s, particularly with

[289] There are many that are even older, but not as globally recognized, from industrial cities like England's Newcastle (1892), Southampton (1885), and Everton (1878)
[290] Trail hiking and other outdoor activities especially in The German Empire Frank Uekötter, *The Green and the Brown: A History of Conservation in Nazi Germany* (Cambridge: Cambridge University Press, 2006).
[291] Paul Sutter, *Driven Wild: How the Fight against Automobiles Launched the Modern Wilderness Movement* (Seattle: University of Washington Press, 2002, 2005).
[292] Lucsko, *The Business of Speed: The Hot Rod Industry in America, 1915-1990.* Chapter 2
[293] Grübler. Page 223 and Table on page 225.

regard to the various national peoples' cars affected, "how individuals use their time – their time budgets …[and]…increased personal mobility…[was]…largely met by motorized vehicles."[294] This meant that people, both families and individuals, had transitioned from just living and acceding to meeting basic needs to actually "having a life", making deliberate spending decisions in a more informed manner than their relatives just a generation before them. Enthusiast participants had the newly budgeted time and money to intentionally spend money on travel to M/S events and not just watch the active participants compete, but to join tens-of-thousands of like-minded constituents over the course of several days in sharing this experience.[295] This is further illuminated by Henry and Angus with, "Events [were] geared to creating a full 'day out for the family' within a clearly understood leisure market dynamic.[296]

[294] Ibid. Page 291. These cars include France's Citroën 2CV, Italy's Fiat Cinquecento, England's Morris Mini, Germany's Volkswagen (the Beetle Bug), America's Chevy Bel Air and Ford Crown Victoria.
[295] Poser. He writes of the creation of Charter companies that escorted tourists to targeted destinations which in our case included M/S competitions.
[296] Henry. Page 15

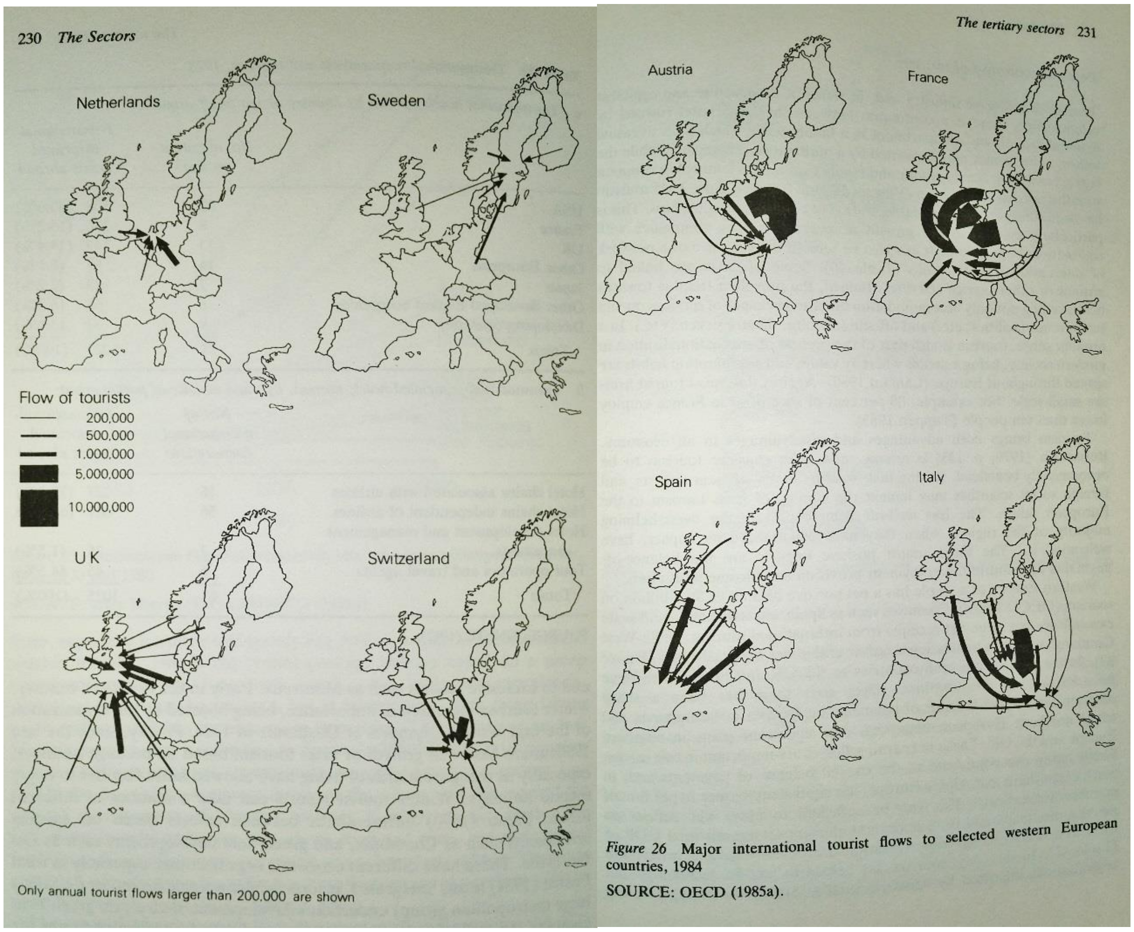

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Fig. 3-6: Graphical representation of tourist flows by destination country in early 1980s shown here as example while volume in 60s and 70s were climbing to this rate except for recessions in 1970s. Starting in the 1970s governments of the European Community (EC) initiated aid to the private sectors in various ways depending upon the country in part because, "In the EC in the 1970s, tourism accounted, directly and indirectly, for some 8.5-10 million jobs."

[297] Allan Williams, *The Western European Economy: A Geography of Post-War Development* (London: Routledge, 1987, 1992). Pages 226-239

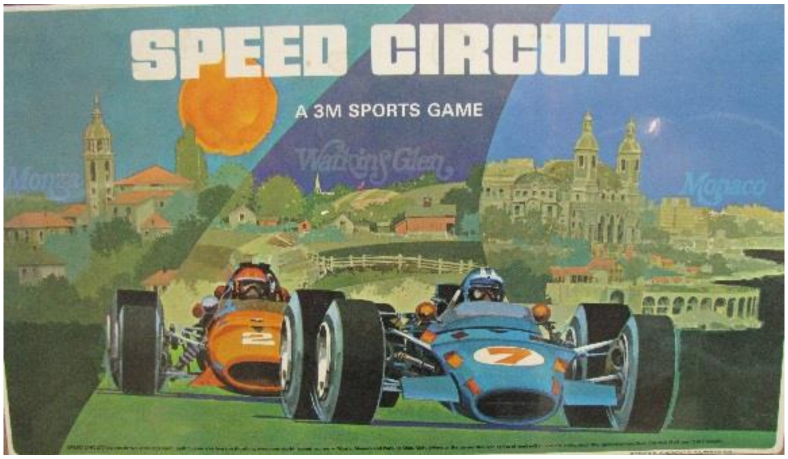

Fig. 3-7 (a) and (b): On the left (a) is 1971 board game cover from 3M. On right (b) are the game pieces in the shape of open-wheel racecars. Courtesy IMRRC, Watkins Glen, NY

There is yet one more relevant aspect to M/S and leisure that requires elucidation here which is the advent of the quasi-experiential activity of arcade games by "driving" an imaginary yet physically present race car on famous tracks or on table-top board games. As M/S gained popularity during the 60s and 70s, and technology enabled a form of shared experience for the enthusiast, and while pinball tables along with "shooting" games had been typical arcade or carnival destinations, the notion that one could "test" their so-called driving and gear-shifting skills on a machine for the currency-related equivalent of a nickel, a dime, or a quarter grew in stature. Many young men, and a few young women in this period had grown up with magazines such as *Hot Rod, Road & Track,* etc. – much like Murray Fahnestock did for the Model-T Ford in the 1920s – with their missives of how to complete DIY repairs or customization for any number of enhancements to their automobile.[298] Thus with the advent of arcade games that placed these adolescents and

[298] Murray Fahnestock, *The Model T Ford Owner* (Lockport: Lincoln Publishing, 1999). See also Lucsko, *The Business of Speed: The Hot Rod Industry in America, 1915-1990*. Carroll Pursell, *From Playgrounds to Playstations: The Interaction of Technology and Play* (Baltimore: Johns Hopkins University Press, 2015).

parents in a safe environment to compete with one another, it encouraged another shared experience. Initial mechanical machines such as the 1930s pinball games did not have the technological capacity to replicate the multifunctional requirements of steering, pedals, and shifting gears. Then, as Carroll Pursell enlightens, “The electromechanical controls of the 1950s and ‘60s were replaced with circuit boards and digital displays in the 70s.”[299] Therefore, while there might have been interest in race-car arcade games prior to the 1970s, it required the basic electronics to enable a more complete racing experience but this era still could not replicate the physical attributes of driving a race-car on racing circuits of the world. Thus, in essence, once technology enabled a more realistic experience young men and young women could live vicariously through a machine what they saw take place on racing circuits for a few coins in their pockets. While writing about driver modelling Peter Wright further elaborates in 2001 that, “Motor racing computer games use exactly these same car and circuit models with various levels of sophistication to generate the dynamic responses of the car.”[300]

With a more foundational understanding of leisure time, this narrative moves next to getting participants to the events. It must be made very clear that, for the most part, the majority of M/S tracks were not in or near major metropolitan hubs or road networks. Those which were found themselves in the minority like Germany’s Hockenheim, and Monaco (for F1), as well as NASCAR’S Talladega in Alabama.[301] Therefore, active participants

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[299] *From Playgrounds to Playstations: The Interaction of Technology and Play*. Page 146. On page 151 he adds how a Japanese company, Namco, “produced a coin-operated mechanical driving simulator called Racer” in 1970.
[300] Wright. Page 186. Further discussion of computer modelling will take place in later chapters.
[301] Both Hockenheim and Talladega are visible from the major highway’s that run past them. Hockenheim was the site where the legendary Scottish driver Jim Clark was killed in the early 1960s. Since that time more circuits have been located in or near major metropolitan hubs such as Montreal’s Circuit Gilles Villeneuve and Austin’s Circuit of the Americas, aka COTA.

with their caravans of car haulers and enthusiast participants with their caravans of campers made use of the road infrastructures as they were. Transforming the route from “A” to “B” along the banded ribbons of asphalt and concrete into some semblance of an appreciative nod to the pastoral became important matters in the 1960s and 1970s. However, this too was a complicated and contentious scenario because efforts to “beautify” these motorways while also expanding the network became matters of pitting the engineering approach versus the creative design approach in opposing tensions.

The concept of highway beautification occurred at a time of extreme divisiveness among those in the field in both America and Europe such that a seemingly simple idea resulted in highly confrontational negotiations as this issue exploded in North America as well as continental Europe and the United Kingdom.[302] However, two of the most noteworthy struggles occurred in West Germany and the United States. In what was then known as the *Bundesrepublik Deutschland* (commonly known as West Germany and abbreviated as BRD), the matter was referred to as *Bundesnaturschutzgesetz* (Federal Nature Protection) along the autobahns which came into being in 1976 and was intended to re-invigorate a planned, strategic approach toward landscaping the highways for visual appeal as initially attempted during the Third Reich.[303] The dilemma, however, was that the predecessor Nazi mandate known as the *Reichsnaturschutzgesetz* created in 1935 was titular only. While the

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[302] See Massimo Moraglio, "A Rough Modernization: Landscapes and Highways in Twentieth-Century Italy," in *The World Beyond the Windshield*, ed. C. Mauch, Zeller, T. (Athens: Ohio University Press, 2008). Axel Dossmann, "Socialist Highways?: Appropriating the Autobahn in the Geman Democratic Republic," in *The World Beyond the Windshield: Roads and Landscapes in the United States and Europe*, ed. C. Mauch, Zeller, T. (Athens, Ohio: Ohio University Press, 2008). Peter Merriman, ""Beautified" Is a Vile Phrase: The Politics and Aesthetics of Landscaping Roads in Pre- and Postwar Britain," in *Th World Beyond the Windshield: Roads and Landscapes in the United States and Europe,* ed. C. Mauch, Zeller, T. (Athens, Ohio: Ohio University Press, 2008).

[303] Thomas Zeller, *Driving Germany: The Landscape of the German Autobahn, 1930-1970* (New York: Berghahn, 2006, 2010). Page 191

words foretold of a symbiotic relationship between those of the hard sciences in engineering and those on the creative side of landscape architecture, it was not to be.[304] Several hundred kilometers of roadway were built but the only nod to landscaping was following the topography of the land. Fast forward forty years, the same familiar notes were played for the same song with mathematically precise clothoid curves transitioning across routes but this time more attention was paid to how nature should have been brought into the planning stages.[305] Tensions were more expansive in the United States but for different reasons as, "from 1956-1975 over 42,500 miles of the continental United States would be paved."[306]

Carl Zimring explains that, "the Highway Beautification Act of 1965…exposed growing tensions between environmental and commercial claims on public space."[307] When President Lyndon Johnson signed the legislation, it culminated many years of disdain toward expanding commercialization along America's highways and byways on the part of his wife, Ladybird Johnson. Zimring shares the *in tempus* quote by Mrs. Johnson that "the legislation aimed for 'pleasing vistas and attractive roadside scenes to replace endless corridors walled in by neon, junk, and ruined landscape'"[308] Indeed, the attacks upon the hospitality aspect found in the commercial growth that were food and lodging were

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[304] Uekötter, *The Green and the Brown: A History of Conservation in Nazi Germany*. Page 61
[305] Mauch. Page 247, n. 38. The clothoid is also known as a Cornu spiral which "has a variable radius…The clothoid curve proceeds from a curve of infinite radius to one of a circle, bringing about the centrifugal acceleration only gradually and thus maintaining the stability of the vehicle."
[306] Cotten Seiler, *Republic of Drivers : A Cultural History of Automobility in America* (Chicago: University of Chicago Press, 2008). Page 71
[307] Carl Zimring, "Neon, Junk, and Ruined Landscape: Competing Visions of America's Roadsides and the Highway Beautification Act of 1965," in *The World Beyond the Windshield: Roads and Landscapes in the United States and Europe*, ed. C. Mauch, Zeller, T. (Athens, Ohio: Ohio University Press, 2008). Page 94
[308] Ibid.

secondary to the primary target – the scrap yard industry which actually served multiple purposes and were not as prevalent in Europe.

First, it was a gathering place for cars no longer in use whether by abandonment, replaced by owner for newer model, damaged in an accident, etc. Second, it was a recycling center whereby cars were either crushed flat so flat-bed tractor-trailers could haul them in a visual replication of stacks of automotive pancakes or shredded to yield just large cubes of metal similarly transported across the highways. The reason this recycling was important was because autobody steel was considered "#1 ferrous scrap grade" which "the steel industry coveted" because it was, "usually cheaper then virgin iron ore and lack or impurities kept electric-arc-furnaces (EAF) from becoming damaged."[309] The down-side of shredding, however, was that it also resulted in "a toxic residue known as automotive shredder residue (ASR) or 'fluff'…[at about] twenty pounds per car" and a spate of federal regulations from 1976 to 1980.[310] The latter year saw the enactment of the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) which also established the now famous Superfund system. Finally, junk yards were treasure troves for the car hobbyist and enthusiast participant owner of an older car because the pinnacle of credibility in maintaining or restoring a car is the authenticity of the vehicle. After-market products did not always look or fit right while original equipment manufacturers (OEM) did to such an extent that an entire specialty industry arose and was folded into a particular network supporting the repair or customization of cars known as the Specialty Equipment

[309] Carl Zimring, "The Complex Environmental Legacy of the Automobile Shredder," *Technology and Culture* 52, no. 3 (2011). Page 527.
[310] ibid. Page 539

Manufacturers Association (SEMA).[311] However, there is a certain patina or "age" that is formed over time to truly original equipment whereas OEM parts fit correctly but look new.[312] While junkyards were not as ubiquitous in Europe as indicated above, there was still an interest in the early 1970s for "the private maintenance of vintage automobiles…[that] went beyond constant tinkering to include the formation of the necessary network of kindred spirits."[313] By eliminating this pipeline of accessible parts for DIY'rs it caused considerable consternation in their quest for authenticity and originality so cherished when they brought their prized possession(s) to shows like the Concours d'Elegance elaborated on in the previous chapter at Watkins Glen as well as at other M/S and car-related events these enthusiast participants entered.

The unsightliness of roadside billboards that were sprouting across America also drew the ire of those in the highway beautification movement. For all participants driving to a distant race, thus unfamiliar with the food and lodging options enroute or at destination, billboards

Fig. 3-8: Tin Can Tourist convention late 1920s - early 1930s. Image courtesy www.tincantourists.com

[311] Philip Scranton, *Endless Novelty: Specialty Production and American Industrialization, 1865-1925* (Princeton: Princeton University Press, 1997). See also, "Technology, Science and American Innovation," *Business History* 48, no. 3 (2006). The SEMA organization appears extensively in Lucsko, *The Business of Speed: The Hot Rod Industry in America, 1915-1990., Hot Rods.*

[312] Please see several articles in the special edition of April 2014 *Technology and Culture* that focused on users of the automobile. See also the new monograph by Lucsko, *Junkyards, Gearheads, & Rust: Salvaging the Automotive Past* (Baltimore: Johns Hopkins University Press, 2016).

[313] Poser.

Fig. 3-9: 1979 Daytona 24-hour race. Notice the RV's clustered in the top of frame. This was only one of several areas allocated to RV and trailer camping. Courtesy IMMRC, Watkins Glen, NY.

announcing campgrounds, hotels, and restaurants were essential to a great majority.[314] For many others in America who were members of auto or travel-related clubs, they did not need that type of directional assistance because they could acquire guidebooks to help them navigate the trip.[315] The participants who needed food/lodging information and were members of an organization like AAA could go to the nearest AAA office as there was one in almost every town and multiple in larger cities in order to acquire a trip booklet called "Trip-Tik" with routes as well as AAA approved hotel/motel locations which had been vetted and, starting in 1965, assigned an approval rating from one to five diamonds. Those towing camper trailers or driving their own recreational vehicle (RV) could rely upon their membership in Kampgrounds of America (KOA) or the Good Sam Club for locations and amenities of their sites.[316] These organizations formalized a network for the modern means

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[314] Shackleford. Pages 106-108. See also Pierce. *Real NASCAR.* Roads were being paved however there were not enough places to eat or sleep initially because it would have violated common business sense to risk capital investment on structures based only on speculation of one or two new events.
[315] The most common membership would have been with the American Automobile Association (AAA).
[316] The KOA organization was formed in 1962 and the Good Sam Club in 1966. My father-in-law owned a medium sized RV as a member of Good Sam Club and we travelled across the United States.

of replicating the notion of travelling without the need for affixed lodging that existed during the Interbellum with the Tin Can Tourists (TCT). As David Burel informs about the car/trailer combination, it was convenient and efficient to have car and trailer because, “Together the car and travel trailer were a recreational vehicle and, when separated, the car was every bit the utilitarian vehicle it had been before.”[317] It was during that period the iconic symbol of mobile freedom in the form of the stainless steel clad Airstream trailer began but while Airstream survived (and continues to thrive), the TCT entity disappeared in the 1960s. However, the ever narrower efficiency quotient rose with the self-contained RV whereby the driver’s seat was also in the living area such that, “the recreational vehicle would increase in popularity after the war in a new era of prosperity.”[318] It became such an opportunity that many racetracks actually had allocated lots for RV’s alongside, but just beyond the track safety fencing itself enabling enthusiasts to sit in the comfort of their mobile domicile with the equivalent of front-row seats. However, none of the American systems addressed neither the matter of dining options nor their quality. That did, however, exist in Europe.

The Michelin Guides published by the Michelin Tire Company have become *sui generis* the source for categorizing a number of attributes allocated to the hospitality industry since the early 20th century in assisting travelers across the globe – and it rated restaurants. What has been known for many decades as the “red” guide for hotels and restaurants was originally published in 1900 in accordance with the desires of brothers Eduoard and André Michelin who saw this publication as a means to both: A) help travelers navigate their

[317] David Burel, "The Trailer Revolution: The Origins of Recreational Vehicles in American Culture," *Automotive History Review,* no. 58 (2018). Page 35
[318] Ibid. Page 43

journey safely, and B) position Michelin as a reputable source of information as a tire manufacturer thus increasing sales.[319] The first edition was small enough to fit in a coat pocket yet combined "399 thin pages" of automotive repair facilities, lodging, and restaurants throughout France.[320] Subsequently, they realized that maps for driving would need to be formatted differently from academic or wall maps and, with André's earlier profession as a government cartographer, this culminated in a usable representation of France which combined the needs of the driver with "what was technically possible."[321]

One of the criticisms of early Michelin Guides was that it was very Franco-centric. That is to say editions were attentive to France or areas directly related to *lingua franca* tourism such as immediate borders and northern African territories. Diffusion beyond those borders did not occur until the late 1950s for "romance language" countries, in 1964 for Germany, the 1970s for the British Isles, with the balance of Europe in later decades.[322] As the guides

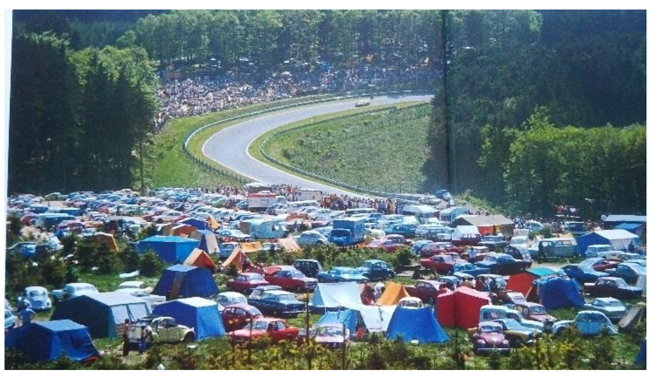

Fig. 3-10: Camping at the N-Ring in the early 1970s. *90 Years Nürburgring*, Lehbrink. Page 236-237

[319] There was (and still is) the green guide which is concentrated on sightseeing.
[320] Stephen Harp, *Marketing Michelin: Advertising & Cultural Identiy in Twentieth-Century France* (Baltimore: Johns Hopkins University Press, 2001). Page 56.
[321] Ibid, page 77. See also, Herbert Lottman, *The Michelin Men: Driving an Empire* (New York: I.I. Taurius & Co. Ltd, 2003).
[322] Andy Hayler, "History of Michelin Guide and Michelin Stars by Population," https://www.andyhayler.com/michelin-history. Accessed 28 October 2018.

expanded that which was French into the rest of western Europe, there was still a perception of bias toward French culinary methods for restaurant ratings which the publishers have been addressing since the expansion. Whether it was the AAA guidebooks or the Michelin guides, these mattered to enthusiast participants because, enroute to or from a race, they gathered at rest-stops for a break or spent the night at *Gasthaus "Zum Wohl"* or *Auberge "Chez Nous"* and shared their experiences of being participants regardless of which driver/team they supported. The same camaraderie took place at countless camping sites, regaling one another with racing stories, humorous race-track *faux pas* incidents, other travels, and so on.

As a final note on getting to the race-course, Sweden underwent a massively significant project greatly affecting automobility. On the first of January 1967 the entire country changed from driving on the left as in the U.K. to driving on the right side like the rest of continental Europe. Oddly enough during this period, of the Swedes who owned cars some had left-hand drive while others had right-drive cars. Furthermore, as Sweden became car-centric, urban areas in Sweden were re-designed, aided by the study of traffic engineering from American universities in order maximize the efficient use of the car.[323] As a result of their approach to life-work balance, the average Swedish worker had several weeks of vacation per year and almost every family had some form of vacation place whether cottage, boat, or camping trailer to get to one. Many travelled to the continent to enjoy racing events in-person as there were successful Swedish drivers such as Joakim Bonnier,

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[323] Pär Blomkvist, "Roads for Flow - Roads for Peace: Lobbying for a European Highway System," in *Networking Europe: Transnational Infrastructures and the Shaping of Europe*, ed. Erik; Kaijser van der Vleuten, Arne (Sagamore, Beach, MA: Watson Publishing International, 2006). See also, Per Lundin, "American Numbers Copied! Shaping the Swedish Car Society," *Comparative Technology Transfer and Society* 2, no. 3 (2004).

Gunnar Nilsson, and Ronnie Peterson at the top levels as well as several others in World Rally Championship.[324] The changeover to right-side driving also simplified logistics by extending previously contested E-roads (due to the left-hand drive) and bringing goods into the country as trade across European countries grew.[325]

Over the course of these decades, enthusiast participation grew from distant onlooker who would only read about results in national papers or the few automotive, or even fewer racing magazines, to more strident involvement as we shall see in the next chapter. Indeed as it relates to this chapter, like the tracks they went to, they evolved from passive consumers of this leisure and entertainment business to a more active role in making pilgrimages in order to share the experience in-person with hundreds of thousands of their peers and like-minded friends. That is what it meant to truly be an enthusiast participant in forming the regional cultures of a system.

[324] It must be noted that Bonnier and Peterson died in track tragedies while Nilsson died from stomach cancer.
[325] Högselius.

CHAPTER IV: THE SPORT AND TRACKS: EARLY 1960S TO EARLY 1980S

Clearly these approximately twenty years were the most technologically significant and transformational of any period for automobility as well as M/S. There were multiple "agents of change" to include creative innovators like Smokey Yunick in NASCAR and Peter Wright in F1, and of course both FIA and NASCAR as regulatory bodies. Yet it was not just transfer of technology, but transfer of power, and transfer of knowledge, and transfer of locus.

In looking at M/S specifically, this elucidation begins with an overview of the sport itself and the essential premise of technological transfer across regions. In Europe, the center of the M/S industry had been the "Motor Valley" in northern Italy and as a result of advances introduced by Mssrs. Cooper and Chapman became de-centered from there and then re-centered to a region west of London, England which became known as Motor Sport Valley (MSV).[326] In America there were pockets of racing knowledge in the northeast, mid-west and far west but with NASCAR it was accumulated in the region around Charlotte, North Carolina. With NASCAR, this had also agglomerated drivers, many from "white-lightning" (illegal, homemade alcohol) couriers, into a cultural community around oval track racing. Following the premise of auto racing which is for a driver to complete a set number of laps around a given circuit in less time than their competitors, technological innovations stretched from the groundbreaking aspects of physics in F1 related to

[326] On "centering" see Braudel. Page 85. It is important to note that chassis' for all open-wheeled world-wide were, and still are, fabricated in the MSV region.

downforce resulting in better grip of the car on the track to the ridiculous of Fan-cars and six-wheeled cars. There were many track innovations which included scoring and timing such that timekeeping had been done manually by wives and girlfriends of drivers with a stopwatch converting to mechanically, then electronically.[327] More soberingly, this period was also the deadliest in all M/S series leading to numerous safety innovations to protect drivers.[328] For M/S active participants at all levels it was also an epoch of massive transformation for both NASCAR and World Endurance Championship (WEC) but primarily for F1 which became molded into a global business network around the concept of Manuel Castells' "five different types of networks".[329] These networks are: supplier (anything related to supplying), producer (anything related to production), customer, standard coalitions (global standard setters), and technology cooperation (facilitate special acquisitions, joint production, and shared scientific knowledge). This was the initial stage in the formation of a heterogeneous network. As a point of clarity, a scientific community is not restricted to bench scientists in white coats or to research laboratories. Scientific communities are also intensively active in the application of scientific laws, methods and principles plus add scientific value.[330]

Next in this chapter will be a chronicle of Bernie Ecclestone's rise to authority in F1 as he maneuvered the transfer of power and control over F1 from the Paris-based bureaucracy of the FIA to a London-based businessman. He was a skilled and successful entrepreneur as we learned in the previous chapter and, in the mind of many, it is solely because of his

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[327] Rendall.
[328] John Matthews, ed. *Grand Prix: The Killer Years* (Manchester: Bigger Picture Ltd., 2014).
[329] Castells, *The Rise of the Network Society*. Page 207
[330] Polanyi. See section 2. Scientific Value, pp 134-142 in chapter 6 Intellectual Passions, Part Two The Tacit Component.

Machiavellian maneuvers in this period that F1 was transformed from elitist control over hobbyist drivers and factory teams into a competitive entity drawing hundreds of thousands of spectators and tens of millions of television viewers at each event. In 2003 a "senior car company executive [said] 'Bernie was the right man for his time, but F1 has outgrown this autocratic, hands-on approach'."[331]

At the beginning of this period we observe, conversely to the growth of NASCAR, the F1 network engaged in self-reflection during the 1970s leading to the removal of two vaunted spaces Spa in Belgium (to be detailed in the next chapter) and the Nürburgring in the Eiffel mountains in western Germany from the annual F1 "circus" as it was commonly referred to by the M/S media. Originally constructed for an inaugural 1927 race, Nürburgring was a venue to showcase the might of German automotive engineering by Mercedes and Auto Union racing teams. It became too mighty. Finally, after racing on Florida's Atlantic beaches, the construction of the Daytona International Speedway would become one of the ultimate venues for drivers to earn a win. The beach races had been taking place for decades along with land speed records on those same beaches just outside Daytona Beach but cars were getting too fast and heavy and too many people relocated to or visited the area to allow that racing to continue.

4.1 THE SPORT

The timeframe extending from the early 1960s to the early 1980s saw a multitude of changes in M/S, some of the more significant ones will be explicated below to include the realization that a winning team was reliant upon successfully applying scientific principles.

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331 Henry, *The Powerbrokers: The Battle for F1's Billions*. Page 38

Racing changed from factory teams and wealthy hobbyists in F1 having drivers compete more for glory than paychecks over to active participants with their own ideas of making cars faster in the same vein that NASCAR drivers had been their own "masters". That stated, at its core, M/S was about science: physics, chemistry, biophysics, and medicine. There was the physical stress that occurred on the materials and drivers; the psychological stress on drivers, engineers, and mechanics; the chemical compounds that became fuel, and nascent forays shaping composites and carbon fiber into sleek bodies; among many others. To that end, team members of M/S series, in controlling air movement and downforce whether drivers, engineers or mechanics, became members of "A scientific community [that] consists…of the practitioners of a scientific specialty" who needed to understand what these principles entailed.[332] On the one hand, Bowler and Morus refer to the bifurcated roles of science and technology as "scientists work with their heads [while] engineers [and] technicians work with their hands"[333] However, in the M/S community of active participants that was no longer the case as the intentional application of engineering and scientific principles became *de rigeur,* everyone had to work with their heads <u>and</u> their hands. The purposeful intellectual assault on paradigms of speed and control became the *raison d'être* and it must be made eminently clear that the number of mechanics who had earned engineering degrees increased toward the end of this timeframe.[334] Thomas Kuhn amplifies that, "A paradigm is what the members of a scientific community share, *and*,

[332] Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1962, 1970, 1992). Page 177

[333] P. Bowler, Morus, I.R., *Making Modern Science: A Historical Survey* (Chicago: The University of Chicago Press, 2005). Page 407

[334] For the last 25 years or so it has become a requirement to have an engineering degree to earn a place on an F1 team and this has also become a necessary credential for both WEC and NASCAR to work on the car's drivetrain.

conversely, a scientific community consists of men who share a paradigm."[335] Pär Blomkvist refers to Bruno Latour's "obligatory passage point" regarding the International Road Federation's (IRF) use of technical knowledge as political power resource.[336] In its application to M/S, it is fitting to equate the "obligatory passage point" as the paradigm-busting efforts meant to "eliminate amateurs" and the full-throated acceptance that winning, "is the most important thing on earth."[337] Finally, in that this chronicle claims that M/S is indeed a network that incorporates technology and science inherent to its existence it is quite necessary to cite Latour directly with his comment that, "If technoscience may be described as being so powerful and yet so small, so concentrated and so dilute, it means it has the characteristics of a **network**."[338] The technoscience he refers to was, in fact, concentrated to the geographical spaces outlined below.

It is important to be aware that a whole host of rule changes in both technical and sporting regulations occurred annually in every series. Any attempt to chronicle even just the major ones for each year would digress from the narrative of this work and a more useful approach is to examine particularly illustrative developments in M/S. To that end, the focus of this section of the chapter will be on: the transfers of the sport's different loci; power through the development of co-produced hegemony in both NASCAR and F1; transcendent technological innovations; as well as general track changes.

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[335] Kuhn. Page 176

[336] Blomkvist. Page 167

[337] Bruno Latour, *Science in Action : How to Follow Scientists and Engineers through Society* (Cambridge, Mass.: Harvard University Press, 1987). Page 150

[338] ibid. Page 180. Bold emphasis in original.

The notion of transfer has a central role in M/S here and manifest beyond just technology but what also what Hughes refers to as "The Culture of Regional Systems."[339]. Notwithstanding the enormous recognition of the Indianapolis 500 around the racing world, up until the 1960s, the center of global open-wheel M/S was essentially in the Emilia-Romagna region of Italy around the city of Modena and known as Motor Valley.[340] Familiar names like Ferrari, Maserati, Lancia, and Lamborghini have been located there from their founding with a second, smaller "island" in and around Turin of the Piedmont region as the home to Alfa-Romeo and the automotive design firm Pininfarina. Racecars from these factories were high-powered front-engine machines that generated straight line speed with minimal regard for handling and which were supported by elements of the Italian government before and after the Second World War. It was not long however, before all of these factory teams fell by the wayside except one due to fiscal reasons, Ferrari. After World War Two the once formidable German factory team Auto-Union was not the same as it was during the Interbellum yet its national competitor, the formerly vaunted Mercedes-Benz returned to a dominant position with their W196 platform clad in unpainted Elektron magnesium-alloy metal resurging the moniker of Silver Arrows it had before the war. The W-196 platform was dominant because it was the first to use desmodromic valves (employed cams and actuators instead of springs), direct fuel injection, and a scaled down variant of the V-12 engine used on the highly successful Messerschmitt Bf-109E fighter plane of the Nazi air force. From the British Isles, Jaguar enthusiastically contributed their

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[339] Hughes, *Networks of Power : Electrification in Western Society, 1880-1930.* Chapter 13 The regional systems he refers to can be correlated to the socio-technical systems of M/S and its various circuits.

[340] F. Alberti, Giusti, J., "Cultural Heritage, Tourism and Regional Competitiveness: The Motor Valley Cluster," *City, Culture and Society* 3 (2012). The Indy 500 cars were more aligned with engines such as Offenhauser than with automotive manufacturer names.

cars to racing events but the technology and knowledge cluster was centered in northern Italy.[341] The bottom line was that F1 racing at that point was restricted to factory marques technologically fencing out enthusiast participants from entry into the competitions.

The de-centering of M/S away from Italy began in the late 1950s with John Cooper's mid-engine design but it took until the early 1960s to begin affecting change in top tier racing with winning results using this chassis. By re-positioning the engine from the front of the vehicle and re-centering it slightly aft of the driver – but not all the way to the rear – this distributed the weight of the vehicle more evenly across the four points of contact where tires touch the track surface known as the "contact patch". Heavy, front-engined vehicles like Ferrari incurred the usual inertial push of the physical load beyond the capabilities of equipment or driver toward the edge of the track thus difficult to steer around corners (there were neither power steering nor power brakes). As a result, the mid-engine design balanced the center-of-gravity near the driver greatly easing the stresses on the vehicle's load in the curve. This was a major factor in controlling the vehicle in navigating turns at two to three G-force equivalents pushing drivers' heads and bodies outward to just after the turn's apex.[342] Additionally, Colin Chapman's experience as an engineer and an RAF pilot after the war led him to pursue a tubular monocoque space frame that made cars lighter while maintaining a stiffness enabling further stability of the car. Thus as others combined both mid-engine chassis with lighter space-frame there was less requirement for heavy and powerful engines. The final factor regarding the cars appeared in the mid-to-late 1960s in

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[341] Pinch.

[342] Connie Ann Kirk, *Taken by Speed: Fallen Heroes of Motor Sport and Their Legacies* (Lanham, MD: Rowman & Littlefield, 2017). Chapter One about the ill-fated Italian world champion Alberto Ascari who had a very thick neck.

the form of the Ford DFV V8 engine – the DFV meaning Double Four Valve indicating four valves per cylinder (related to intake and exhaust) and twice the cylinders of the regular four-cylinder motor.[343] These saw the emergence of a large technology cluster which Grübler refers to as one that "initially develop[s] within specialized application or in specific market niches."[344] These major British innovative designs and methods required specialty manufacturers and suppliers to be nearby as there was no overnight delivery industry as exists today. Again considering Braudel, by re-centering M/S from northern Italy to the region between London and Birmingham in Great Britain, it consolidated specialty manufacturers and enabled a large enough body of active enthusiasts to acquire very capable racing cars and successfully compete as privateers against the factory teams.[345] The Ford DFV-powered, Cooper-chassis, and Chapman-framed cars were available at a low enough price range that many single-car teams were formed and a couple of those two-car teams are still in existence in F1 today.[346] These "garagistas", as Enzo Ferrari pejoratively labeled them, became increasingly competitive as the delivered vehicles were actually open-ended artifacts on their own because each team implemented their own innovations within the FIA homologations in efforts to squeeze tenths and, later in the period, hundredths of seconds out of lap times which forced Ferrari to ultimately convert to mid-engined cars.

[343] Jenkins. Page 951

[344] Grübler. PP 117-118 He defines a technology cluster as, "a set of interrelated technological and organizational innovations whose pervasive adoption drives a particular period of economic growth, productivity increases, industrialization, trade, and associated structural changes,"

[345] Braudel. Page 80. See also, Henry.

[346] The most notable are eponymous teams by New Zealander Bruce McLaren and Englishman Frank Williams.

In the United States, racing had more of a scatter-shot concentration with pockets in California (more along short, straight-line drag racing)[347], oval track racing in the upper Midwest, the northeast, and especially in the southeast. NASCAR's Bill France was able to overcome the challenges of competing race organizers and either hostile or dismissive urban media by maintaining an iron-fist control over the appearance of respectability for the first two decades. As will be amplified further below, he built a network of circuits to attract large enough bodies of participants in order to host races at the extant dirt tracks. This, then, stimulated enough interest for him to start building paved racetracks across the southeast ultimately leading to the construction of super-speedways like Daytona in Florida, further elucidated below, and the venerable Talladega in Alabama.[348] The majority of the early NASCAR tracks regionally encircled the track at Charlotte, North Carolina and, as a result, the area around Charlotte became the locus for NASCAR technological innovation and as a knowledge base. While the MSV in England became the global center for M/S as a technology cluster, the greater Charlotte MSA was much more concentrated on the various NASCAR series, therefore exemplifies the more modest definition of a technology cluster defined by Rogers that it, "consists of one or more distinguishable elements of technology that are perceived as being closely interrelated."[349]

In both regions, there were many small manufacturers who created a wide variety of components and assemblies, all were co-located in technological clusters which further

[347] See, Post. and Lucsko.

[348] Talladega is to this day the largest and fastest superspeedway closed-loop oval in the world at 2.66 miles.

[349] MSA means Metropolitan Statistical Area. For the quote see, Rogers. Page 14. Regarding knowledge institutions see also, Kimmo Viljamaa, "Technological and Cultural Challenges in Local Innovation Support Activites - Emerging Knowledge Interactions in Charlotte's Motor Sport Cluster," *European Planning Studies* 15, no. 9 (2007).

enhanced knowledge migration, however there was a difference. This development can be viewed as an example of the third of Joachim Radkau's suggested "three features of 20th century large technical systems" as explained by van der Vleuten. He writes that, "second order large technical systems are constructed by combining familiar (1st order) systems to create a new function."[350] Here, the first order is specialty flexible manufacturing for any type of automotive end-product, and the second order is the ever more specialized flexible manufacturing for like components that have different specifications that cannot be utilized in any way or anywhere outside the narrow bandwidth that is M/S. In Italy's Motor Valley, production and diffusion was restricted to factory teams of the time and few suppliers. With the re-centering to the MSV, production and diffusion of knowledge and technological innovation moved to a second order in that no regular street cars were produced there. Instead, Charlotte and the MSV each became a repository of codified knowledge on how to set up racecars to have victorious results yet all the while administrative participants knew that teams were energetically working to circumvent any miniscule technical loophole to generate the extra boost in power enabling the driver to overtake the competition.[351]

Innovation in M/S came about in several ways. Exemplars in NASCAR can be found in both the very simple and the more complex. As an example of an elemental new process of execution, there was the basic activity of changing tires. Over the course of a 500-mile race in this series, tires had to replaced approximately five to eight times depending on the

[350] Erik Van der Vleuten, "Understanding Network Societies: Two Decades of Large Technical System Studies," in *Networking Europe: Transnational Infrastructures and the Shaping of Europe, 1850 - 2000*, ed. Erik; Kaijser van der Vleuten, Arne (Sagamore Beach, MA: Watson Publishing International, 2006). Page 287

[351] On codified knowledge see: Mowery. Page 47.

abrasiveness of the track surface, track temperature, car settings, etc. While fuel was added with a 22-gallon, gravity fed canister held by one very large and strong crew-member, another crew member was responsible for lifting the car (known as "jacking" the car) on each side while four other team-mates removed/replaced tires. The simple action of "jacking" up the car required man-handling a 40-50 pound awkward piece of equipment and exerting full-body pressure depression on the handle in a multi-phase sequence thereby lifting the car a few inches at a time until sufficiently raised from the pit lane surface to replace tires. In the mid-1960s, the pit crew with the team of Leonard and Robert Wood innovated their jack mechanism device resulting in fewer strokes thus several fewer seconds in the pits putting their driver back on the track much earlier than competitor drivers.[352] This seemingly minor innovation of a more efficient pump-jack was a hugely significant and critical improvement in M/S technology and was copied in different variations by the other teams

On a more purposeful plane in NASCAR, one can only look to the colorful and sometimes controversial Smokey Yunick who, as a mechanic, earned for his drivers almost 60 victories, two NASCAR championships, and a Daytona 500 win. A gifted and inventive mechanic, Yunick was able to find a few extra horsepower, a few extra miles per gallon, but always hovering around the legalities of racing regulations. What is remarkable about Yunick was not just that he could extract every element of power and speed from a machine but that he was the owner of twelve automotive and safety patents, responsible for numerous automotive innovations, and inducted into the International Motorsport Hall of

[352] Shackleford. Page 206

Fame in 1990.[353] A deliberate innovator not just for M/S, many of Yunick's inventions had the possibility to be implemented on regular street cars, not just racing cars[354]. These are but two scenarios to illustrate the various conditions in which innovation took place in NASCAR during this phase. As von Hippel explains, innovation can take place anywhere, which in M/S means on the pit lane, in the team shop, or in more pressure-filled venues.[355] There were no sophisticated computer or research facilities during the 1960s and 1970s, innovation was by experimentation and, indeed by accident or as Polanyi affirms, "Accident usually plays some part in discovery and its part may be predominant".[356] As an example of innovation by accident, we can simply consider the word "cardboard". While testing aerodynamics and the relation of fluid dynamics effect on F1 cars, it occurred to the Lotus chief engineer Peter Wright to affix pieces of cardboard to the side pods of the Lotus racecars during 1970s wind tunnel testing to explore effects on the bottom of the car. By realizing this example of fluid dynamics applied to the car, it held tightly to the "floor" of the test facility which translated to mean the track surface.[357] To re-iterate, these are but three exemplars of many hundreds of pioneering efforts on and in racecars yet each one, while of different magnitudes, greatly affected how teams changed some dynamic in order to win.

The problem for every M/S team was to eke out the last possible bit of speed, control, braking. To accomplish this required a certain type of knowledge. As it pertained to M/S,

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[353] Westin, "Motorsports and the Motoring Public at Full Song (1950 to 1965): Measuring Men, Creatively Destroying, or Stimulating Technology?."

[354] Among his patents are: US4592329A, Apparatus and operating method for internal combustion engine; US4068635A, Pressure vent; and US5246086A, Oil change system and method.

[355] von Hippel. Chapter 3

[356] Polanyi. Page 120

[357] Ludvigsen. Chapter 8

Collins is spot-on with his statement, “Knowledge is also sometimes kept secret by elite groups.”[358] There is no quibbling that top-tier M/S participants are elite groups and the knowledge they own while on a team was highly secret and remained wholly and only on that team. The discovery of solutions like the one above is what drives mechanics and engineers in M/S. In that same vein, Polanyi adds that “nothing is a problem or discovery in itself; it can be a problem only if it puzzles and worries somebody, and a discovery only if it relieves somebody from the burdens of the problem.”[359] It is important to keep in mind that whether it might be a seemingly minor issue or a weightier dilemma of great magnitude for active participants, for them to comprehend that, “In choosing a problem the investigator takes a decision fraught with risks.”[360] What might have been a simple solution could have had, and according to expert analysis on multiple broadcast media during races, often did have unintended consequences. It was critical for the engineer or mechanic to realize whether or not the “problem” he identified was actually a problem that would affect the car’s performance or simply an inconvenience that would not impede the lap times. While speed is always foremost as a goal, control is only fractionally behind speed. Among the more relevant factors of control is downforce, or how the car is pushed closer to the ground, but is a delicate balance between downforce for control in turns and curves versus less downforce at “full song” on straight sections of track.[361] During this phase many risks were taken to find an advantage in this area, mostly in F1 and WEC but marginally in NASCAR.

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[358] Collins. Page 92
[359] Polanyi. Page 122
[360] ibid. Page 124
[361] Chuck Edmondson, *Fast Car Physics* (Baltimore: Johns Hopkins University Press, 2011). Chapter 3; Ludvigsen. Chapter 8; Wright. Chapter 8

Fig. 4-1: 1960s extreme wings.
Courtesy: http:atlasf1.autosport.comevolution1960s.html

Evolving during the 1960s, the concept of downforce through the use of wings took hold as the method to produce victories. Initially these structures were based on the physics of aircraft wings but were not designed well enough to withstand the lateral and horizontal G-forces exerted upon the ridiculously slender supporting rods from the varying, if not absurd, heights and sometimes multiple wings. The history is replete with cars shedding detritus throughout the racing space as a result of this attempt to enhance downforce in F1 and several other series. It did not take long for administrative participants to discontinue authorization of this innovation.

Starting in the 1970s experimentation began with acquiring a better understanding of the concept of venturi tunnels under the cars and the Bernoulli principle of airflow. This approach led to a number of innovative techniques to capture these notions by people like Peter Wright and his devising sliding skirts on the side of F1 Lotus cars based on the circuit conditions. The purpose of this innovation was to enable the driver/car system to optimize

Fig. 4-2: 1978 Brabham Fan Car
Courtesy: http:www.motorsportretro.com201208brabham-fan-car

the car to the course conditions. The Lotus team dominated the late 1970s with its Type 78 driven by Andretti and Peterson.[362] As the teams' knowledge and expertise of this concept extended into the 1980s there was an unintended consequence of the cars being unpleasant to drive and drivers who complained of the cars' unpredictability leading to the eventual banning of this technology by the FIA. But it was not just wings and skirts that were attempted and banned. The Brabham racing team in 1978 devised a large fan device at the rear of the car pulling air from the front and out the rear which resulted in a victory in its one and only race at Anderstorp at the grand Prix of Sweden.[363] Among the reasons it was banned shortly thereafter were blowing surface gravel into the following car and unequal development cost potential . Other attempts at extreme innovation in F1 were turbine engines and four-wheel-drive however the lack of resources by all teams to equitably implement these innovations led to them being banned by the FIA.

It is informative, however, to examine particularly unique efforts that were launched during this phase. First of all, there was Chapman's effort in 1981 for a twin-chassis Lotus. This

[362] Foxall. Page 397
[363] Jenkins. Page 895

was truly a paradigm-shifting idea, using a dual chassis system to spread the vehicle's load across eight separate suspension points. The driver compartment and powertrain system were on the internal chassis which was attached to a separate external chassis. While it technically met the regulatory requirements, it was politically untenable against the other teams' vociferous complaints to the FIA and banned almost immediately upon its implementation.[364] The protest had nothing to do rule breaking or safety, it was simply that Ferrari and others had not discovered the innovation and could not produce an equally effective version thus Ferrari's superior power as an active participant above other teams was affirmed. The second radical endeavor to elevate teams' over their competition was that three teams designed 6-wheel vehicles which were seemingly even more outrageous. The French oil company sponsored team Elf-Tyrell designed its P34 with two sets of forward wheels, both of which were steerable, was actually competitive with a win and several second place finishes across the 1976 and 1977 seasons and is the most recognized car in M/S history.[365] The 1977 Brabham (same team as experimented with the fan-car) and the 1981 Williams both attempted to take advantage of reduced drag with four smaller rear wheels that did not protrude above the car's "deck" profile but never won. All in all, however, the matter of equitablility, resources, and changing tire compounds virtually pre-determined that these efforts at six wheels would be banned by the FIA and they were in 1983.

What was the common, unifying thread across these problem-solving attempts at helping their drivers win races? It was a particular technical community. A specific community

[364] Ludvigsen. Pages 275-277

[365] Henry, *Autocourse: 50 Years of World Championship Grand Prix Motor Racing*. Page 182

with specific knowledge and skills put toward a specific goal. Mary Jo Nye frames it well in her Foreword to the 2015 re-publication of Polanyi's seminal work *Personal Knowledge*, "Like Polanyi, Kuhn described science as a social community, and he highlighted the productive tension in science between tradition and innovation or stability and change."[366] Yet it was more than just science, it was the intellectual knowledge coupled with the tacit knowledge gained from experience that resulted in the different approaches toward solving the same problems. From the early 1960s through the early 1980s, mechanics and engineers had to rely on their senses and the senses of the driver regarding sounds, smells, and the feel of a racecar. They were in nascent stages of correlating scientific principles and methods to the development of racecars. Subsequently, as Kuhn states, "people do not see stimuli…they have sensations, and we are under no compulsion to suppose that the sensations of our two viewers are the same."[367] As it pertained to drivers, top tier racecars are not interchangeable with another driver as each has their own feel and driving style thus the set-up for each practice, qualifying, and actual race must be attuned to that individual pilot.[368] On the part of mechanics, Krebs informs that, "Professional sensory skills should be understood as situated social practices, shaped through the perceptual framework of the trade. Mechanical and sensory skills constructed and maintained hierarchies in the repair shop, and they demarcated experts from non-experts"[369] Clearly, top tier M/S mechanics are experts as they work with the most complex automotive systems in the world thus, they have gained *ostensive knowledge* as Collins labels it, "knowledge

[366] Polanyi. Page xxiii
[367] Kuhn. Page192
[368] Mansell. Mansell is the only man in M/S history to have earned both World Drivers Championship (F1-1993) and open-wheel CART (now Indy Racing League) Championship (1994).
[369] Krebs. Page 381

that can be learned only by pointing to some object or practice because the description in words…would be too complex to be spoken and apprehended."[370] They gained this knowledge, experience, and wisdom by different means, with different mentors/ teachers, at different times, in different places. Yet the net effect was that they all learned to use the same tools and machines which had specific procedures and limits. On this Polanyi explains that, "Technology teaches only actions to be undertaken for *material* advantages by the use of *implements* according to (more or less) *specifiable rules.* Such a rule is an operational principle."[371] Over time this was translated into specific experience to which Collins relates, "The ability to make good judgements is often referred to as 'intuition', and that is a useful term so long as we remember that it is 'wisdom based on experience'"[372] This state is known as "ineffable connoisseurship" in some academic corners, or as a specific societally-based "collective tacit knowledge" among others.[373] Transfer of this knowledge in M/S mandated both requisite understanding of the technology itself in this unique scientific community as well as awareness of other members of the community and their understanding of the same knowledge and the same technology. The latter was required because people flowed across teams over a career thus joining people with new secrets to embrace then hold to themselves once learned.

As a final note in this section, I make a challenge to one of Polanyi's assertions relative to M/S. He states that, "Electrotechnics and the theory of aerodynamics are examples of *systematic technology* which *can be cultivated in the same way as pure science.*"[374] Yet as

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[370] Collins. Page 93
[371] Polanyi. Page 176 Italics in original text.
[372] Collins. Page 149
[373] For the first quoted phrase see, Polanyi. Page 88 For the second phrase see, Collins. Page 11
[374] Polanyi. Page 179

has been explicated above and will again be detailed later, car handling in M/S was far from pure science. Cooper was a tool-maker in the RAF prior to his radical mid-engine concept which changed how cars were designed with less frontal area required. Chapman was an engineer as well as a postwar RAF pilot prior to his monocoque frames which also changed how cars were designed. Peter Wright as will be revealed was an engineer with practical application solutions for side-skirts. Theirs were not “bench engineer” pure science efforts akin to Vannevar Bush’s “basic research.”[375] Theirs were absolutely “applied research” with specific M/S problems to solve. Thus, it is enlightening to refer to Polanyi again as he comments that, “Personal participation changes from an impetuous pouring out of oneself into channels of untried assumptions, into a confident holding of certain conclusions as part of one’s interpretive framework.”[376] This interpretive framework constituted the “ineffable connoisseurship” in M/S that drove their experimentation.

4.2 ADMINISTRATION OF RACING

Any competitive sporting activity requires governance and with the addition of intricate technologies, that administrative participation role became exponentially more complicated during this approximately 20-year period and it was approached in a bifurcated way. The regulation of tracks and safety in F1 and WEC was quite loose in the 1960s due to a weak FIA and power residing among the race organizers. As NASCAR grew to a national brand, Bill France consolidated power through a co-produced hegemony

[375] Vannevar Bush, "Science - the Endless Frontier: A Report to the President on a Program for Postwar Scientific Research," (Washington, D.C.: National Science Foundation, 1945).
[376] Polanyi. Page 172

over track owners and drivers. Driving in France's races was profitable for most but only under the auspices that France established. Any renegade driver who did not want to abide by France's rules, like a clean car, did not race. In the latter half of this phase, Bernie Ecclestone (BE) began amalgamating his control over F1 also through his own co-produced hegemony in a number of ways to be profiled below.[377] Since both of these men had previously raced as drivers and later as owners, this no doubt greatly informed and fortified their ascension to power.

In his book *The Anatomy of Power*, John Kenneth Galbraith quotes Max Weber that "power is 'the possibility of imposing one's will upon the behavior of other persons."[378] In categorizing power instruments he offers three which are: condign, compensatory, and conditioned. Condign is negative in method where the alternative to submission is "sufficiently unpleasant or powerful", compensatory comes by "offer of affirmative reward", and conditioned is "exercised by changing beliefs."[379]

In NASCAR, Bill France had the "show" as it was referred to by him and in the media and all tracks were dirt circuits but as asphalt and concrete surfaced venues were built out of safety concerns to handle higher speeds and heavier cars, track owners wanted to host races and began paying fees to NASCAR for that privilege. During that period income was "based more on attendance than on revenues from television broadcasts".[380] This singular topic will become immensely important later in this narrative but at the time there was no broadcasting of races. As more tracks were built France had more options therefore if a

[377] On co-produced hegemony see, Krige.
[378] John Kenneth Galbraith, *Anatomy of Power* (Boston: Houghton Mifflin Company, 1983). Page 2
[379] ibid. Pages 4-5
[380] Shackleford. Page 227

locale wanted to host NASCAR races at any series level, they had to succumb to France's requirements. The same mindset was required of drivers – if you want to race you follow Big Bill's rules, period. Those who abided by France's rules and edicts were competitive and earned a very good living as their reputations soared but those who didn't adhere, they struggled. In the early 1980's when car owners could afford forming multi-car teams in earnest, the relationship of this co-produced hegemony withered from condign power to conditioned with racetracks becoming a negotiated space.

In F1, conversely, track owners were a very loose network and approached Grand Prix racing entirely from a colonial and nationalist pride standpoint which was stronger than FIA leadership. FIA management was focused on F1 being a European exclusive activity where it was a privilege for non-Europeans drivers to compete, but there was not so much concern about safety.[381] Even into the 1970s, drivers were thought of as gladiators, that "drivers were dispensable…there were plenty more drivers to choose from who would jump into the car and go, no questions asked"[382] As a car owner Bernie Ecclestone (hereafter as BE) became a member of the Formula One Constructors Association (FOCA) which was the organization of privateers or "garagistas" that were based in England. It started occurring to him in piecemeal fashion as early as 1973 that with the strength of galvanizing these independent teams in opposition to the arrogance of race organizers, the importance of television broadcast opportunities, and the value of sponsorship, he could

[381] Adas. Especially chapter 3 on Global Hegemony in that "they had earned the right (and duty) to be the 'lords of'" [M/S] because of the "superiority of Western civilization." Pages 143-144
[382] Kirk. Page 177. On the perception of drivers as gladiators see also, M.; Levinson Cipolloni, S., "There's More Than Handwriting on the Wall and Here's the Concrete Facts," AutoRacing1.com, http://www.autoracing1.com/MarkC/2002/0918Injuries.asp.

consolidate power over time and turn F1 into a successful business. Across this phase, BE alternated how he exercised power via all three instruments as needed for the situation.

The crucial element to comprehend is that driver and spectator safety was becoming of paramount significance to both active and enthusiast participants yet even through the early 1980s was marginalized by administrative participants. From the early 1960s to the early 1980s, a total of 37 drivers in all top series were killed on racetracks either by racing, practicing, or testing, but these were not the catalysts for change.[383] No, it would take the survivors of truly frightening crashes to be the champions for safety, not just for drivers but also for spectators. Primary causality for these incidents was that technology had surpassed the capability of the physical space to harness any out-of-control machines and secondarily, it was due to inadequacy or lack of barriers around the circuits.

For the case of technology overtaking the circuits, it was a matter of innovative car builders, engine builders, and engineers delivering more speed, downforce, and aerodynamics resulting in exponentially faster cars. In NASCAR, the oval tracks initially had only a single layer of Armco guard-rail barrier and it was not long until cars at the superspeedways hurtled over those inadequate barriers.[384] To their credit, however, NASCAR officials quickly rectified this problem by increasing the Armco to three layers followed by concrete walls encircling the race space and some early form of catch-fencing to inhibit detritus

[383] Henry, *The Grand Prix Companion*. Pages 272-276; Kirk. Pages 203-206; E. S. Watkins, *Life at the Limit: Triumph and Tragedy in Formula One* (London: Macmillan, 1997). Pages 206-213; This figure also includes Indy 500 fatalities. This figure does not include spectator or race marshal fatalities of which there were several but the most alarming was the 1961 repeat at Monza of the Le Mans disaster when Wolfgang von Trips car was involved in an entanglement with Jim Clark and was catapulted into the stands killing 15 spectators.

[384] Armco is the eponymous manufacturing company and the term is used in M/S in the same manner as the commonly used terms Kleenex, Xerox, Velcro, and Google.

from a crash entering into the spectator space. For F1 – and to some extent WEC – the race space in the early 1970s (particularly of these highlighted venues) was essentially the same physically as it had been during the inaugural events in the 1920s despite advances in automotive technology. From the end of the 1965 season and "going into 1969" cars were faster (bigger engines), better grip (aerodynamics), with more efficient braking, yet F1 tracks themselves and their administration were essentially lagging. They were a hindrance to expansion of the sport and were in dire need of technological upgrading for safety reasons. The 3-time F1 World Champion Jackie Stewart described the situation best as, "The sport wasn't out of control [but] it had developed itself beyond the physical elements of the track"[385] He would know not just from many years of racing, but because he narrowly escaped death in the 1966 Grand Prix of Belgium at Spa.[386]

Racing at the Belgian course Spa-Francorchamps has always been a true test of a driver's mettle more so than any other location because of its climatological and topographical challenges to be revealed in the next chapter. Winding through public roads with no safety delineation of the race space from the houses, farms, pastures, and concrete telephone poles lining the course, it was at once exhilarating and terrifying according to multiple drivers over the years. At the beginning of the 1966 Grand Prix of Belgium the weather turned from dry to abominably torrential resulting in a number of driver crashes to include Jackie Stewart and Graham Hill which will be detailed in the next chapter. The upshot of the outcome of this race was that Stewart became a vociferous champion for safety overall

[385] Matthews. Page 42

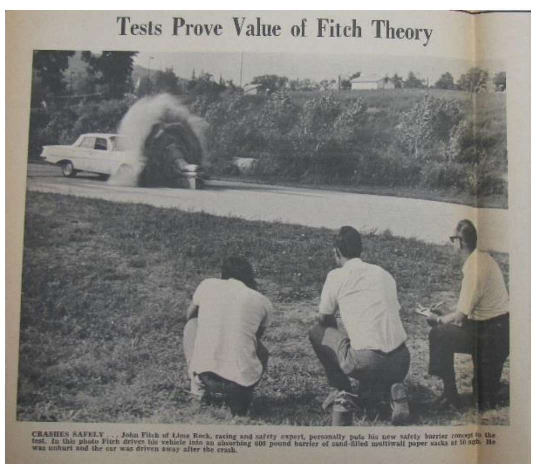
[386] Jackie Stewart, "Motor Racing Circuit Safety," *Auto Racing Magazine*1969. Pp. 22-29. In: Motor Racing Safety Society Collection (12A40) Box AR-I-1, Folder Motor Racing Safety, IMRRC, Watkins Glen, NY

who was outspoken in his effort to garner support to end racing at two of the most venerable and iconic venues of the F1 series, Spa and later the German Nürburgring which will be revealed later in this chapter. He also gained the support and respect of a highly acclaimed former driver and engineer, John Fitch, who himself had been directly involved in a famously major incident in M/S – the 1955 LeMans crash with multiple crowd fatalities and his work will appear more than once hereafter. While actual racecourse efforts overall to improve safety were innocuous with run-off areas, gravel pits, etc. there were some innovations which collectively contributed to the reduction in crash-related serious injuries and fatalities from a 1-in-8 at the beginning of this phase to, "an average of 1-in-40 accidents – a 5-fold improvement" by the early 1980s.[387]

Another fearsome reality drivers faced was the instantaneous deceleration (also known as "negative acceleration" from the purely technical point of view)[388] of a rapidly moving vehicle against an immovable object which, even to this day is a conundrum for many sports involving high-G-force impacts like American football, rugby, hockey, soccer/football, and the resurgence of boxing, Mixed Martial Arts (MMA), and Underground/United Fight Club (UFC). Internal organs such as the brain, predominantly, have no braking/attenuating mechanism thus are subject to inertial forces and velocities of the incident. These same issues were factors for regular street cars and in the 1960s American John Fitch (introduced above) was concerned about regular commuters in the United States and how to minimize deaths or injuries from highway accidents. The result

[387] Peter Wright, "The Role of Motorsport Safety," (United Kingdom: Federation International de l'Automobile, 1998). Page 1265
[388] On "negative acceleration" please see: G. Savage, "Formula 1 Composites Engineering," *Engineering Failure Analysis* 17 (2010).

of some of those fatal crashes were compiled by the Ohio State Patrol in video format then subsequently distributed well into the late 1970s to school districts across the United States as part of driver education campaigns – when it was still available through the school district. In his research to combat senseless highway carnage, Fitch developed a novel method to mitigate serious crashes with his patent # 3,606,258 (20 SEP 1971) "Energy absorbing deceleration barriers".[389] He effectively changed the course of many lives as state level Departments of Transportation across the United States and later other countries implemented his sand barrier containers for highway egress protection, racing pit lane entrances, and any other potential high-impact areas. His patent was successfully affirmed in 1993 against an incursion by a competitor with the presiding judge citing Fitch's background in M/S, safety, and as an engineer.[390]


Tests Prove Value of Fitch Theory

CRASHES SAFELY . . . John Fitch of Lime Rock, racing and safety expert, personally puts his new safety barrier concept to the test. In this photo Fitch drives his vehicle into an absorbing 600 pound barrier of sand-filled multiwall paper sacks at 50 mph. He was unhurt and the car was driven away after the crash.

Fig. 4-3: Fitch's sand barriers. Courtesy IMRRC.

389 John Fitch Collection, (99A72) Box AR-L-3, Folder 1998 SAE Motorsports, IMRRC, Watkins Glen, NY.

390 John Fitch Collection, (99A72) Box AR-L-3, Folder "Not Labeled", IMRRC, Watkins Glen, NY

4.3 Watkins Glen International (WGI) – GROWTH AND FAIL

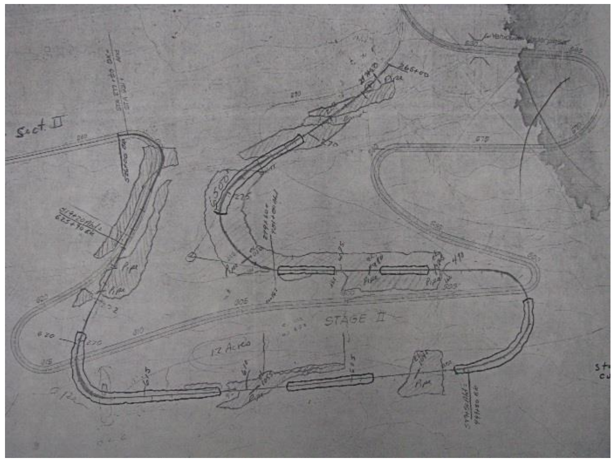


Fig. 4-4: Blueprint of the final "Boot" addition with alternatives shown. Courtesy IMRRC. William Green Library, IMRRC, Watkins Glen, NY

In returning to the narrative of the upstate New York road course from the previous chapter it is a tale of two tracks. On the one hand it is about investment and growth while on the other it is story of another failure in M/S. First the growth. As the 1960s drew to a close, the Watkins Glen Gran Prix Commission (WGGPC) decided to expand the circuit and the final design revealed the addition of what was (and still is) known as "the Boot" which lengthened the circuit from 2.3 miles to slightly more than 3.37 miles with even more

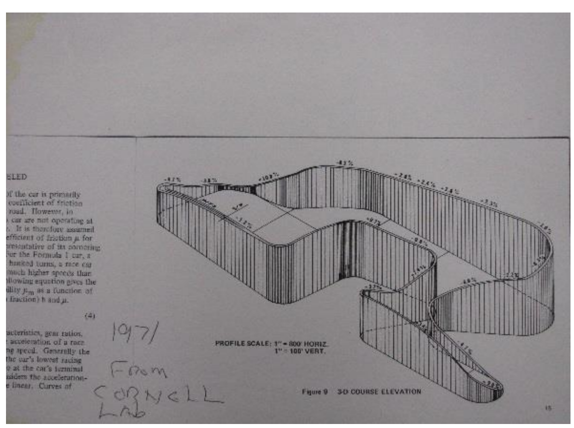


Fig. 4-5: Complete topographical representation of the final track design. Courtesy IMRRC. William Green Library Motor Racing Library, Book Two, 1956 - _____

significant topographical features. Furthermore, they did not just make it longer, they also widened the racing surface which allowed for more side-by-side racing competition that all enthusiast participants looked forward to observing. Having learned their lesson from surface degradation for the inaugural race in 1956, this time the pavement contractors were held to the asphalt mixture formula as well as proper curing methods. The matter of barriers, however, was still a problem for the F1 racing.

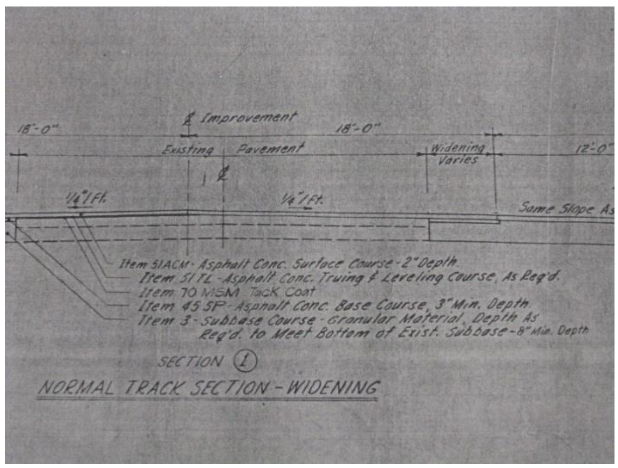


Fig. 4-6: Pavement specifications from engineer firm Tallamy, Bird, Tallamy, and MacDonald. Courtesy IMRRC. William Green Library, IMRRC, Watkins Glen, NY

Even though the FIA mandated as of 1970 that racetracks must be outfitted with double-stacked Armco, drivers were continuing to die or be injured. A combination of faulty installation or design, combined with powerful cars and no outlet for energy dissipation meant high-velocity, high G-force impacts. These problems were continual throughout the 1970s across the global F1 network of circuits with one of the most egregious occurring at the 1974 Grand Prix of Spain where the Armco barriers were not attached to the vertical post bolts, merely resting on them. Several drivers including the Brazilian world champion and future Indy 500 winner, Emerson Fittipaldi refused to race, even taking to the course to properly connect the components themselves all the while having the Spanish race organizers impound the cars if they did not conduct the race event – which was eventually run. But WGI was the fulcrum for the turning point with the death of rising French star Francois Cevert from vaulting over the Armco during practice. The crash occurred due to an irregularity on the track surface that upset the highly sensitive car and was confirmed by Jackie Stewart who recreated the lead-up to the crash the same day of the accident. For Stewart, who had been planning to retire at the end of the season, it became a turning point after having surveyed the grisly scene immediately after the crash and then making the confirmation lap of the likely cause, he did not start the race, he retired then.

There were a variety of issues beginning to coalesce and which portended a bleak future for WGI. The first was the continued scrutiny about implementation of Armco in context of the era of ground force cars because they were known to be, in M/S parlance, as "twitchy" or nervous. This meant anything which interrupted the science of aerodynamic downforce, load, handling, and enhanced grip of the asphalt. Next was the matter of FIA upgrade requirements for tracks year over year which were costly. While documentation of the matter is not known to exist anymore to this author, one of the major detractions of the overall facility was inadequate water and sewage disposal. In order to situate the dilemma it is necessary to know that the racetrack is at the top of a series of knolls and is the high ground for the immediate area. In 1971, WGI had to rely on well-water from only three of the twelve surrounding wells requiring the use of portable toilets, and even by 1973 there was no running water. Indeed by the early 1980s a system of levies and pumps resulted in a few "flushers" in the Glen Club building in the center of the infield. More were added in the mid-1980s but it was not until 2003 that municipal water was routed to WGI. [391] This was a major problem with approximately 100,000 spectators.

As will be discussed further below, by the late 1970s BE's ruthless negotiation tactics resulted in European circuits paying the equivalent of $50-60 thousand dollars to host a country's singular F1 event but WGI and other non-European places had to pay more than $100-thousand which it had trouble meeting. Additionally, despite 10 years of tradition as the final race of the season and remaining "4 weeks after Monza", the Monza race date was not consistent. Thus, for a number of reasons, the FIA was threatening to remove WGI from the 1977 schedule because WGI's customary second weekend in October was a schedule conflict for the FIA.[392] The point must be clearly stated that other racing events and outdoor concerts were held here but none drew as many people at one time as F1 weekend. This reality eventually led to bankruptcy and 1980 as the final F1 race. However, the Phoenix-like resurgence of WGI rising from the ashes will be briefly chronicled in the next chapter.

4.4 THE PROFESSOR, Dr. Sid

Sid Watkins grew up in his father's garage and loved working on cars eventually growing up to be the unlikely combination of a world-class neurosurgeon and the medical director for F1. His training at Radcliff Infirmary, Oxford placed him near the British Silverstone Circuit site of the very first F1 race of the new World Championship series in 1951. In an autobiographical recounting of his time as F1's Director of Medicine and Surgery, he

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[391] Personal conversation with William Green, IMRRC historian. On the matter of adequate water and sewage infrastructure see: Joel Tarr, *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective* (Akron: University of Akron Press, 1996).

[392] WGGPC Corporate Records, Box 3 CR-3-B, Folder WG Grand Prix Corp. IMRRC, Watkins Glen, NY

informs that this "had enabled and encouraged me to indulge my interest in Grand Prix racing"[393] He later served as Professor of Neurosurgery at Syracuse University and regularly worked at the WGI facility from 1962-1970. This background not only informed his knowledge and trained his skills regarding the peculiar medical events uniquely found with high-speed vehicles, but it also informed BE as the new "boss" of F1. In the spring of 1978 BE approached Dr. Sid to lead safety and medical services support in F1. After a few meetings with various other stakeholders like Mario Andretti, Niki Lauda, and James Hunt, the Professor agreed.

The first item on his agenda was to immediately and personally examine the medical facilities and assess safety support set-up at every track used by F1. His approach was quite a radical departure from normal procedures of the past and as commonly occurs with change there was considerable resistance if not total dismissiveness at every facility. Because each setting was in a different country the national rules and even local laws, or lack thereof, were sometimes impediments. As Dr. Sid would uncover, they had every reason to be hostile because almost every site was inadequate across many criteria like qualified specialists such as cardio-thoracic, neurologic, and orthopedic surgeons, anesthetists, helicopter transport, trauma equipment that would be found in any trauma Emergency Room and so on. By no means any attempt at a comparison but it must be stated that the first F1 race a Silverstone in 1951 had "no medical teams on-hand."[394] From these site inspections, he was better informed on the current state and the need for standards so he developed a voluntary checklist to be completed by administrative participants at each

393 Watkins. Page 14. He was referred to as both Dr. Sid or The Professor.
394 Kevin Watson, "Formula One Cars: Safety," SaferMotoring.co.uk, www.safermotoring.co.uk/formula-one-cars-safety.html. 2011

circuit and which was resoundingly ignored. Subsequently this statement of rejection caused BE and Dr. Sid to change tack and made the revised form a mandatory process in order to host any F1 race, and it was well-known that BE did not ever bluff. Despite the howls of protestation each venue completed the documents to include a checklist on the facilities of the supporting major hospital/trauma center. This fundamentally altered the entire mindset of medical support at M/S events under the FIA domain.[395]

There was a turning point both personally for BE and Dr. Sid as well as administratively for F1 as the sporting entity and the FIA as a governing body. It was the 1978 Italian Grand Prix at the venerable purpose-built racetrack known as Monza and the death "Super Swede" Ronnie Peterson. Peterson was another star known for his speed and driving skill such after several years of growing his portfolio of victories he was a very close second in points

Fig. 4-7: Photo from Swedish website:
http://www.ronniepeterson.se/subc/eng/olyckan.html.
Peterson is in the yellow suit on the ground and his car is the black one at top of image. James Hunt is in white suit stepping over Ronnie's legs.

[395] It is important know that medical and safety support at the Indy 500 had been the gold standard for all other racecourses to compare with and still is today. NASCAR ovals were of several sizes thus requirements were not the same for all.

behind his Lotus team-mate Mario Andretti competing for the championship. Eventually Andretti won and accepted with deep sadness.

The race began at the usual time in the usual manner for the initial 500 meters. The specifics of which driver did what in causing the crash and during the ensuing melee is less germane than what did and did not happen after the cars stopped moving. Once they were all still, the flash fires eventually doused, and the smoke had cleared, the true carnage emerged. People tried to come running from all areas which spooked the Italian carabinieri national police. They immediately formed an armed cordon effectively blocking anyone from intruding upon the scene which had negative consequences for two of those people. The first was Dr. Sid and an Italian race official who were prevented at gunpoint from attending to Peterson's injuries no matter what the official said. The second was BE, the boss of F1 himself was also stopped at gunpoint until Monza's Chief-of-Police Giuseppe Marrone "pulled his revolver on his subordinate" and they passed through.[396] All the while there had still been no rescue response team able to get to the accident and the man who pulled Peterson from his smoldering car was none other than James Hunt, the 1976 world champion whom we shall see more of later in this chapter. Hunt could not have known that his friend and fellow driver had 30 broken bones in his lower extremities and he was much later heard to state this event haunted him such that he retired from racing the following year. While admittedly an awful injury, Dr. Sid was able to settle his nerves at Monza's on-site medical center and then team owner Colin Chapman arrived to be transported together to the hospital. Peterson underwent several hours in surgery and when Dr. Sid left

[396] Bower. Page 96

for the night, he felt the Peterson was out of danger – but that was not the case.[397] What was not known was that fatty embolisms broke free from the bone marrow in his legs, blended into the bloodstream clogging lungs, kidneys, brain, and confirmed when Dr. Sid used an ophthalmoscope where he saw "fat globules obstructing the small arteries in the retinas of both eyes."[398] Ronnie Peterson was dead approximately 14 hours after the green flag dropped. It should be no surprise that the retired Sir Jackie Stewart with his campaign for better safety was immediately in contact with people to ensure complete and accurate information was made public.[399]

As a review of the catastrophic mis-steps would show, many procedural changes were necessary. With the chaotic nature immediately post-crash there was no information provided to anyone about anything and the estimate of time for a rescue vehicle to reach Peterson ranges from 11-18 minutes. Also the small and very basically equipped medical center was insufficient for severe traumas as well as inadequately staffed. The resultant changes that were to be implemented in F1 were profound. Not only did BE place Dr. Sid in charge of medical procedures for all F1 circuits, he de-centered power and control over all rescue arrangements at every track from their staff, he re-centered control under Dr. Sid along with all medical processes. Furthermore, he concurred with Niki Lauda and Jackie Stewart as they supported Dr. Sid's requirement to mandate a "follow-car with medical support on the first lap."[400] In fact Dr. Sid was well ahead of his time on this subject as a study in the late 1990s on M/S safety validated on-scene intervention of 1-2 minutes

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397 Ewan Tytler, "What Really Happened at Monza in 1978: The Death of Ronnie Peterson," Kaizar.com, http://atlasf1.autosport.com/2000/ita/preview/peterson.html. Accessed March 2012.
398 Watkins. Page 35
399 Communication between Jackie Stewart and Dr. Faulkner; Dr. F. Faulkner Collection (06A10), Box A, Personal Correspondence, IMRRC, Watkins Glen, NY
400 Watkins. Page 37

significantly reduced on-track mortality rates and it specifically addressed "late death from pulmonary embolus after tibial fracture."[401] These were to be implemented with haste as BE pointedly reprimanded officials at this iconic Italian national landmark that, "We won't race here again unless you improve the medical facilities."[402] This was one of BE's most emphatic manifestations of condign power as his co-produced hegemony progressed over a facility as powerful as the *Autodromo Nazionale d'Italia*. Thus, the only year that Monza did not host an F1 race was 1980 while it underwent refurbishment. Dr. Sid would spend the next thirty years working for the FIA on improving and monitoring all aspects of safety in M/S to include shepherding the creation of a massive compendium titled *Medicine in Motorsports* as his final great contribution.[403]

The preceding paragraphs are not to imply that no efforts toward driver safety took place at all as the focus above was specifically about the race space itself and its inadequacies. In 1970, the FIA mandated that a barrier must exist between the track and pit road, in 1972 they developed Circuit Safety Criteria, and in 1977 they included the need for gravel bed traps to halt cars. However, they were quite toothless in enforcing this upon the national circuits with any sincere effort. Fire was the overwhelming danger for drivers as it had consumed half a dozen drivers in race crashes over the six years split by 1970 itself. That very year, an article appeared in the German publication *Auto und Sport* discussing the development of on-board fire suppression systems for racecars.[404] In the February 24, 1971

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[401] T. J. Chesser et al., "What Are the Requirements for Medical Cover at Motor Racing Circuits?," *Injury* 30, no. 4 (1999). 293-297, Page 296.
[402] Bower. Page 97
[403] Gary Hartstein, ed. *Medicine in Motor Sports*, First ed. (FIA Institute for Motor Sport Safety and Sustainability, 2011).
[404] Staff, "Löschautomatik," *Auto Motor und Sport*1970. Motor Racing Safety Society Collection (12A40), Binder AR-I-1, IMRRC, Watkins Glen, NY

edition of the American journal National Speed Sport News with dateline London, there was a lengthy article about driver fire-suit testing.[405] These are but two examples of many which delineated the polar opposite attitudes toward driver safety chosen by administrative participants of that era who would have to pay for and implement track upgrades versus active participants who could implement certain changes relatively easily and enthusiast participants who were demanding an end to the tragedy and sorrow which they believed was damaging the sport and the community to which they belonged.

4.5 WOMEN AS ACTIVE PARTICIPANTS

It is important to acknowledge the women of M/S during this timeframe who were active participants, not as drivers but still part of the team in F1. First of all, many of the girlfriends, fiancés, and wives had the crucial role of timing and documenting each lap speed during practice, qualifying, and the race itself.[406] Timing was vital during those years as it is today. Whenever changes were made to the car such as suspension components, carburetor settings and spark plug gaps, gear ratios, tire pressure, ad inf., each of these modifications no matter how minor affected the cars handling and behavior in any number of ways thus lap times would be different. Furthermore, climate and atmospheric conditions also had an impact the car's behavior. Therefore, it was essential to have as many data points as possible prior to the actual race in order deliver the ideal set-up for the driver and these datapoints came from the lap timing compiled by the women. Some were very good at this and others admittedly not so good. Jacqui Hamilton was among the latter

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405 "Fire Protective Materials Undergo Rigid Testing," *National Speed Sport News*, February 24, 1971 1971. Motor Racing Safety Society Collection (12A40), Binder AR-I-1, IMRRC, Watkins Glen, NY

406 Louis Stanley, *Strictly Off the Record: Grand Prix Controversy and Intrigue* (Osceola, WI: MBI Publishing Co., 1999). Chapter 7 – Feminine Trends

and was timing during the 1973 Dutch Grand Prix at Zandvoort when her boyfriend, driver Roger Williamson was killed in a fiery crash.[407] Conversely, Nina Rindt was quite good, as recounted during an interview, at how the timekeeper clicked the stopwatch as the car drove by and "had to deduct the [lap] timing [from the overall car timing] so you knew exactly how every car did. You had it all in your book…Today it's all done by computers. *We* were the computers. It was quite fun."[408] Nina's husband Jochen was killed in 1970 Monza and is the only driver ever to earn the driver's World Championship posthumously. As electronic technologies became readily available in the crossover to the next phase, manual timing was supplanted by timing lights and computers.

These two ladies were among the 50+ widows or siblings or parents left behind following fatal F1 crashes from this period. The unequivocally common sentiment among these survivors was the bitterness at how the administrative participants essentially ignored them, their needs, and their dignity during what was one of the lowest emotional points of their lives. Nothing was offered to them from the FIA, or the track officials, or the race organizers. It was up to the teams to deal with the widows, transportation back home, estate settlements, etc. Their sentiments tie back around to Jackie Stewart's equally angry viewpoint as a driver that obliquely connects with notions of leisure by Grübler and Poser from previous chapter. During an interview he opined, "We were not at war. We were competing in a sport – almost a leisure-time sport, for public enjoyment."[409] Theirs are bittersweet tales of joy, love, excitement, loss, and sadness.

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[407] Matthews. Page 200

[408] ibid. Page 157. Italics in original.

[409] Kirk. Page 71

4.6 BERNIE ECCLESTONE

Eventually he took to racing as a driver in some secondary series' of English M/S in the early 1960s but his poor vision hampered his driving results. Having earned his considerable wealth by 1971, he bought the Brabham F1 racing team formed by the Australian Jack Brabham, a 3-time F1 world champion with considerable engineering expertise. As a result, he became a member of the F1 Constructor's Association (FOCA)[410] formed in 1963 by Colin Chapman to unify the British "garagistas" and enable them to compete with factory teams from the continent. At the 1971 FOCA, BE suggested they unite and designate someone as the central figure to negotiate rates directly as a FOCA group with tracks but none of the of the other owners spoke up so he volunteered to accept the mantle – for a commission/fee. This was the beginning of his domination of F1 as they gladly accepted his conditions.

That year was of major significance because BE had somehow acquired documentary evidence that: 1) the FIA was prejudiced against teams from the United Kingdom, 2) race organizers were reaping massive profits from Grand Prix races, and 3) teams could be paid almost ten times per race than their *in tempus* current remuneration. As he set about negotiating with the teams and the tracks, Max Mosely, another FOCA member through ownership of the March team – plus future president of the FIA and a credentialled attorney – engaged BE about his process to which BE told Mosely: "Your problem is you always want things absolutely clear and sometimes it's better if things are not clear."[411] This was

[410] The original acronym was F1CA but one of the first changes by BE was to FOCA which is the common term.
[411] Bower. Page 62

emblematic of his *modus operandi* for BE throughout his career – do not get into details and there will be a way out of a problem. Bower continues on the next page how by the Fall of 1971, BE "had negotiated improved terms with the circuits and the freight contractors."[412]

BE had proven to the FOCA members what so many already knew, he was a hustler who moved quickly and without remorse. The net result was that by 1973, FOCA members were indeed being paid well **<u>from</u>** racing versus paying to go **<u>to</u>** racetracks, they were paying less for globally transporting cars and teams to races, and they did not have to deal with the uncomfortable aspect of individually negotiating with tracks as they had in the past. By acquiescing to BE's conditions, their operations were wealthier and more efficient thus BE's compensatory instrument of power extended his co-produced hegemony of the F1 network. That year was also another turning point for BE in a business sense as he began to realize the global reach of this network and that he had become the focal point in that sense of this entity by organizing and negotiating directly with tracks and race organizers, bypassing the FIA.[413]

Later that year, knowing of the potential financial risk to him, he invited the other FOCA members to jointly invest in a company together and reap the benefits/profits that he had thus far enjoyed individually. Strangely, they had "a uniform reply: 'No, you do it'"[414] They were comfortable not having to be involved with the operational details of an F1 race team and simply focus on racing. This was a seminal moment of ignorance by the FOCA

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412 ibid. Page 63

413 Rendall. Page 136.

414 Bower. Page 64 He also bought the freight company, Cazalay Mills, that teams would pay to transport their cars and equipment across the globe thus generating even more profit for BE.

members, who were absolutely in racing for the money, as they could have united in a company that would have generated far greater wealth as a business than even the very good income they would earn as FOCA members. While he was not certain that the risk would pay off, this became another element of BE's absolute control over F1. As the 1970s calendars marched forward and F1 continued growing in popularity, BE continued raising fees that race organizers had to pay each team in order for the track to continue being part of the F1 travelling show, as it was called by media members, he also began inserting clauses into each track's contract assigning television rights of F1 races to FOCA and since TV was of minor consequence to the tracks, they did not pay attention to this new element.[415] A major oversight by FIA administrators

This, of course, was met with great ire by the race organizers as BE chose to negotiate with each locale individually versus through the FIA so the organizers reached out to the FIA for help in reining in the little man from his intrusion into their sacred "pot-of-gold", which was their perceived ownership of F1 along with FIA. Thus began the first of many battles between BE/FOCA, BE and FOCA, BE and the FIA/FISA. These disputes alone are worthy of their own dissertation and will not be addressed here beyond any cursory relevance to more relevant and specific elucidation. Retribution and bias by the FIA against FOCA ranged from changes to technical regulations that only factory teams could afford, banning innovations by English teams, or intransigence by FIA leading to the threat of all FOCA teams breaking away to form a new global racing championship which would have been, in effect, the death knell of F1. In the end, after much rancor and intervention by a few sensible, objective senior managers of the many FIA Directors, the war ended over a

[415] Henry, *The Powerbrokers: The Battle for F1's Billions*. Pages 71-74

meal at the Place de la Concorde in Paris resulting in the final product being named the Concorde Agreement dated 11 March 1981.What was not obvious to, or noticed by, the arrogant and self-absorbed French president of the FIA, Jean-Marie Balestre, was BE’s insertion of a clause lasting four years into the future “assigning all F1 TV rights and income…to FOCA” Oblivious to the implications, Balestre, an arrogant and self-absorbed character, unwittingly approved this critical concession.”[416] Through these actions it is evident that a network morphology had taken place dramatically reorganizing power relationships. As Castells explains, “the network morphology is also a source of dramatic reorganization of power relationships. Switches connecting the networks…are the privileged instruments of power. Thus, switchers are the power holders.”[417] BE was a switcher in this context and he would continue to be challenged by the FIA on the morphology of the network and its center of power but for the time-being he undisputedly held it

4.7 THE NÜRBURGRING (aka N-RING)

It is an unfortunate reality for academic research that elucidation of the N-ring circuit is limited to secondary sources due to lack of access to internal archive sources.

The village of Nürburg is situated in far western Germany near the tri-national borders of Belgium, Germany, Luxembourg approximately 75 kilometers from the Belgian circuit to

[416] ibid. Page 116
[417] Castells, "The Global Network.", Page 621


NÜRBURG – Rheinland-Pfalz – 543 – 160 Ew – Höhe 593 m 36 C14
Berlin 644 – Mainz 152 – Aachen 133 – Bonn 56
ADAC Ring Boulevard
Hügellandschaft★
Nürburgring★ (Erlebnispark Nürburgring★)

Lindner Congress & Motorsport Hotel
Stefan-Bellof-Straße ✉ *53520*
– (02691) 3 02 50 00 – www.lindner.de
154 Zim – 169/189 € 209/229 €, 21 € – 5 Suiten – ½ P
Rest *Nuvolari* – (02691) 3 02 51 76 – Karte 29/41 €
Das moderne Design in dem Hotel am Nürburgring ist ganz dem Motorsport gewidmet. VIP-Etage mit Zugang zu Tribüne und Hubschrauber-Landeplatz auf dem Dach. Bar und Spielkasino. Geradlinig-elegantes Restaurant mit angrenzender Terrasse. Davidoff Lounge.

Dorint
Grand-Prix-Strecke ✉ *53520 – (02691) 30 90*
– www.dorint.com/nuerburgring
206 Zim – 68/189 € 102/229 € – 1 Suite – ½ P
Rest – Menü 25 € – Karte 27/42 €
Modern-funktional sind die Zimmer dieses Tagungshotels in einer vor allem für Motorsport-Fans einmaligen Lage. Besonders interessant sind die Zimmer zur Rennstrecke hin. Restaurant mit Sicht zur Start- und Zielgeraden, Cockpit Bar mit Autosport-Dekor.

NÜRNBERG – Bayern – 546 – 505 670 Ew – Höhe 309 m 50 K16

Fig. 4-8: Nürburg hotels, note name of first hotel. 2014 Deutschland *Michelin* Guide, personal photo of personal copy

be profiled in the next chapter. This geographic area is the location of the Eifel mountains of which there are three sections, the Voreifel (foothills), Hohen Eifel (upper Eifel), and the Schnee Eifel (snow Eifel). As can be surmised, this region would pose topographical challenges to building a M/S circuit and while not far in distance from the metropole of Bonn it is was nonetheless distant in atmosphere and setting.[418]

For a brief period before World War I Kaiser Wilhelm wanted to have road races of the same ilk as those held in France at Le Mans which took place before WW I and then again after the war. Subsequent leaders at various levels of government sought some normalcy but much like the scenario at Watkins Glen, the competition had to be moved to a built environment for racing. Though the new space was not a national park like WGI, it had been undisturbed by human intervention in the form of field and forest, or *wald* in German. This terrain had a paradoxical meaning ascribed to it and as mentioned in previous chapters,

418 It is about 55 kilometers from Bonn that was the capital of West Germany during the Cold War prior the 1990's reunification, also known as the *Deutsches Einheit*.

this notion of meaning regarding nature and natural was a tenuous one at best according to Cronon, White, Radkau, et al. That said, and in the context of German beliefs in early 20th century as Nazis were in the ascendancy, the opposing sides did loudly ascribe importance or lack thereof on the natural environment. Unlike positive receptions to build and race at WGI and Daytona, sentiment in the Eifel region was more aligned with a negative attitude in the way Lime Rock was perceived.

Like Hughes' *Walchensee* example in Bavaria mentioned in an earlier chapter, a large segment of the population in this Eifel region was rural and favored land policies that either protected or conserved nature, which in itself was a major debate in Germany – to protect or conserve? During the Weimar Republic there were schisms in the passionate declaration that protection of nature was of primary urgency versus those who believed conservation was a better approach. The semantical impermanency of these two terms has yet to be resolved.[419] The finer points of each argument are not the focus here but this issue must be acknowledged in the greater context.[420] There was a third and very substantial element to the relationship between human and nature during the Interbellum and that was the personal appreciation/enjoyment which was manifest in two ways, the "stroll" and the *wandervogel* (transliteration is "hiking bird")

Radkau provides an eloquent and brief history of the "stroll", or *spatzieren,* as a late 18th century innovation that Gudrun König informs was a "'history of the feeling for nature.' By promoting digestion, the stroll eliminates a major source of physical discomfort in

[419] Radkau. See also, Uekötter, *The Green and the Brown: A History of Conservation in Nazi Germany*.
[420] Among the literature with more detail on this debate are: *The Green and the Brown: A History of Conservation in Nazi Germany*., Zeller., and Radkau.

members of the sedentary classes."[421] With regard to the *wandervogel*, Zeller has a greater in-depth discussion of this mainly youth-oriented organization. Among its purposes this movement sought to provide, "the experience of unknown nature provided emotional access to one's self, self-discovery, and a way of dealing with entry into adulthood."[422] On the other hand, there was a segment of environmentally conscious Germans who considered the *wandervogel* and mass *spatzieren* as "horde hiking" and destructive of the natural space thus vehemently opposed it.[423] Nonetheless, *"spatzieren gehen"* became a huge element, if not ethos, of the very fabric of German culture and must be considered as an essential aspect to their relationship with nature. Relatedly, one of the primary actors in the construction of the *Reichsautobahnen* (RAB), as the Nazi German highway system was known, was Alwin Seifert who was deeply influenced during his formative years by learning about "nature" and he had an early penchant for what is now known as STEM courses. This had a profound impact on his approach to, and disagreements during, construction of the RAB because some of the lessons learned from building the N-ring were implemented in the RAB.

Against this backdrop of a pro-environmental populace comes the more pressing economic tension of the Interbellum financial hardships in that life in the Weimar Republic was not easy with rampant inflation and high unemployment. Thus, after Kaiser Wilhelm II (a M/S supporter) proposed a "special racetrack" in one of several locations in 1909, the eventual selection centered around the village of Adenau in the Eifel terrain but was delayed by WW

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[421] Radkau. Page 224 This activity is still widely done in Germany except that in the modern era it is less for physical health and more for mental "cleansing". Author's personal experience.
[422] Zeller. Page 32
[423] Uekötter, *The Green and the Brown: A History of Conservation in Nazi Germany*. Page 22

I. Even though the Kaiser abdicated in 1918, the cause of auto racing remained among many early enthusiast participants in that area leading to racing on public roads in the same vein as WGI. The difference here was that even though, "in 1924, authorities confine farmers and their animals to the villages. But with a lot of pedestrian traffic still on the track, fatalities overshadow the event."[424] Understandably a horrifying situation, the chairman of the Adenauer District of Germany's Allgemeiner Deutsches Automobil Club (ADAC), Dr. Otto Creutz opposed the use of public roads to race cars.[425] In a confluence of related circumstances, Dr. Creutz proposed an idea similar to American president FDR's New Deal to the Cologne (*Köln*) mayor Konrad Adenauer of a way to employ thousands of area workers looking for some form of gainful employment.[426] Prior to this proposal, decades of Prussian leadership saw this region as its workhorse but without adequate remuneration thus the people of this region had grown accustomed to being a downtrodden populace in the larger Germanic worldview. Whether Mayor Adenauer had any particular environmental persuasions is unclear but the future Chancellor of *Bundesrepublik Deutschland* (BRD) who would steer the country through the postwar economic explosion known as the *Wirtschaftswunder*, concurred that the project should go forward. With a similar enviro-technical approach as with Olmsted's plan for the reconstruction and re-direction of Niagara Falls, the contracted companies began, "carving the "Ring into the Eifel turf"[427] Additionally, the Weimar Republic was the only "nation-state" without a

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424 Hartmut Lehbrink, *Nürburgring, 90 Years: The History of the Famous "Nordschleife"* (Bielefeld: Delius Klasing Verlag, 2016). Page 25

425 The German ADAC is equivalent to the America AAA.

426 One of the villages central to the N-ring, is Adenau however it remains unclear to this author if there is any direct correlation to the man, Konrad Adenauer who would go on to become Chancellor of postwar West Germany.

427 On Niagara Falls see: Fein. Chapter IV. On carving into the Eifel see: Lehbrink. Ibid

large-scale auto racing venue in that the United States had its Indianapolis, the United Kingdom had Brooklands**,** Monaco had its street circuit in Monte Carlo, Italy had Monza,

France had LeMans, and Belgium had Spa. Thus the Weimar needed some manner in which to project power and metaphorically to be perceived among the power nation-states in Europe – despite their economic realities. Also, construction of the banked areas mimicked the techniques used at England’s Brooklands track in 1907.

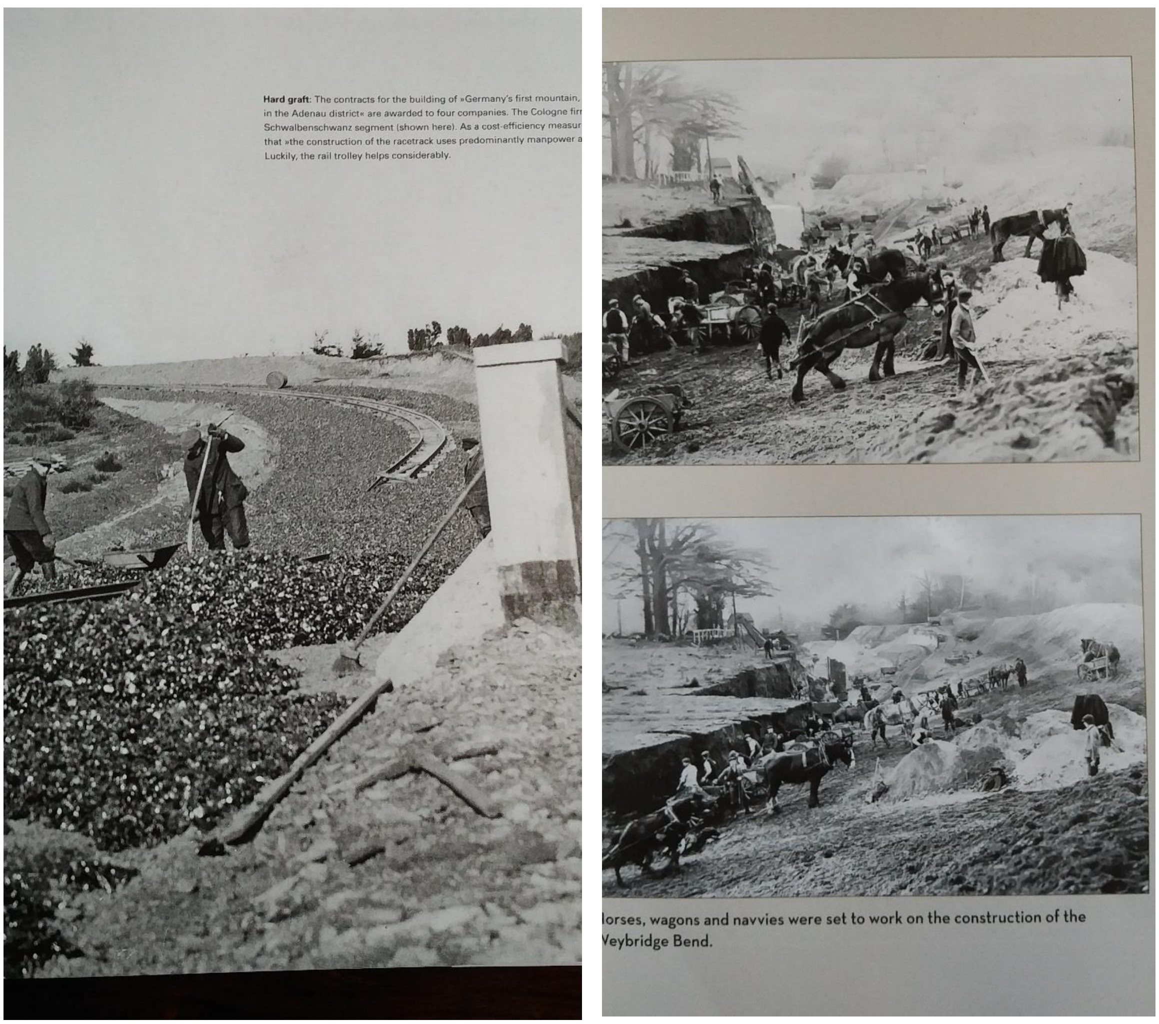

Fig. 4-9 (a) and (b): Varying construction methods for banking at racetracks. On the left, construction of banking for the N-ring, 1925. Lehbrink, *90 Years Nürburgring,* p. 21. On the right, earlier construction of Brooklands banking prior to its 1907 opening. Cross, *Around the Circuit*, p. 67

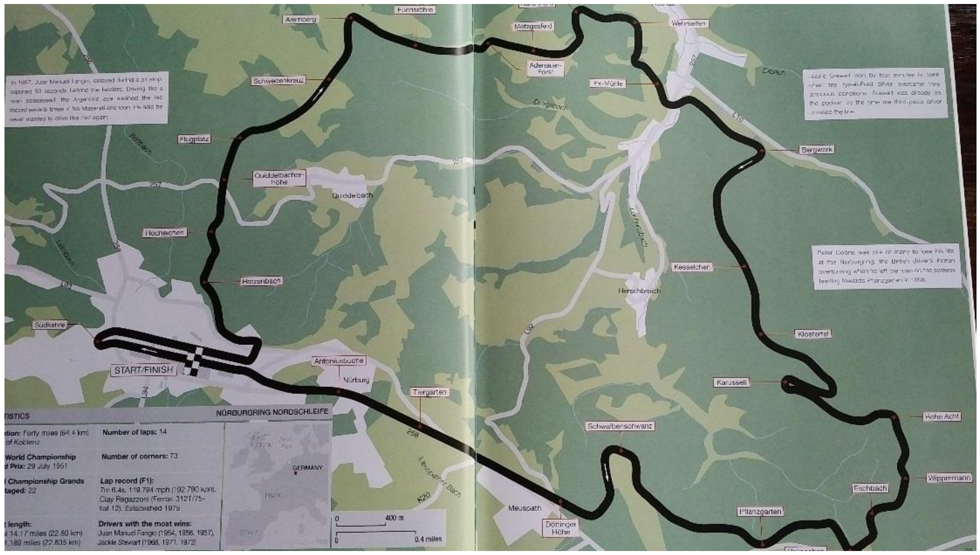

Fig. 4-10: The entire Nürburgring Nordschleife. Hamilton, *Grand Prix Circuits,* pp. 22-23

When construction was finished there were two sections of the N-ring, the intimidating *Nordschleife* (northern section) and the subdued *Südschleife* (southern section) with a track length of almost 23 kilometers (14 miles) for the former and approximately 5.5 kilometers for the latter, but the concentration here is on the Nordschleife. The namesake castle, Nürburg, dates back to the 11th century, is encircled by the Nordschleife, and regally presided over the inaugural weekend of 18/19 June 1927 with more than 150,000 spectators and an estimated 20,000 vehicles clogging the roads at a prideful, patriotic event.[428] The final racing circuit was the result of "twelve million working hours providing earning opportunities for more than 2,000 people."[429] In the debate of German environmental conservation/protection versus economic hardship of the region, Konrad Adenauer faced a leadership challenge and whether he made the right choice is not within the scope of this

[428] Maurice Hamilton, *Grand Prix Circuits* (Glasgow: Harper Collins, 2015). Page 20
[429] Lehbrink. Page 28

document. What <u>is</u> in scope was how the race space acquired its shape in its transition from public roads to a purpose-built facility on an incredibly challenging topo-graphical terrain. With more than 170 corners/curves and continuous elevation changes ranging from 620 meters above sea level at its highest point to 320 meters above sea level at it its lowest point, the Nordschleife has been the most difficult circuit to circumnavigate on the F1 calendar.[430] In the words of many drivers across many decades, this course was both exhilarating and terrifying.[431] What is astonishing is that there were no barriers along the track to keep cars on the track and protected from rock walls and the forest that surrounded the asphalt coated surface. Further, as car speeds from the 1950s through the early 1970s increased exponentially there was no effort to eliminate the 17 bumps that sent cars completely airborne thus, technically, out-of-control upon landing. It was only due to muscle memory, adrenaline, and testosterone that, for each of the 17 humps over the 22

Fig. 4-11: One of many jumps. This was a minor hump but the gap between front left tire and pavement is emblematic of the danger at more than 250-kmh. 08A1_Barnett_Collection_1975_German_GP_IMRRC_002.tif, IMRRC, Watkins Glen, NY

[430] Joseph Twaronite, *Nürburgring Nordschleife: An Enthusiast's Bend Guide* (Middletown, DE: Twaronite Publishing, 2008). Pages 41, 65
[431] Lehbrink. Section 5

kilometer course, they were able to navigate the obstacle. Further, it must be made abundantly clear that even the most skilled and alert drivers in the world were terrified mentally and had accepted the real possibility they might die that day during the race.

If one were to disaggregate the competitive from the pleasure one could make the case that a reasonable Sunday drive around the N-ring might be the automotive equivalent of *spatzieren gehen* among the verdant splendor. But that was not possible (and still is not) as the track was the setting of fierce competition on the white-knuckle edge of control to the extent that even multi-year F1 champion Jackie Stewart gave it a moniker in the 1960s that remains in effect into the 21st century – the Green Hell. This perception led to the 1970 boycott by the Grand Prix Drivers Association (GPDA) of racing at the N-ring. At that point on the timeline, there were no Armco barriers and the immense size and terrain of the entire course was an impediment preventing any truly rapid response to crashes, among several other deficiencies.[432] Recommendations from the GPDA included double Armco and chain-link fencing however when it came time to plan the racing calendar, the N-ring was superseded for the familiar Hockenheim further to the East as modifications had been made there since the death of world champion Jim Clark in 1968.

[432] Georg Bohlender, "Safety Fast? *Zweifelhafter Nürburgring-Boykott Der Grand Prix-Fahrer*," *Auto Motor und Sport*1970. Motor Racing Safety Society Collection (12A40), Box AR-I-1, Folder Motor Racing Safety.

The F1 calendar would return the following year after some upgrades were implemented but the renaissance was short-lived. In 1976, during the Austrian world champion Niki Lauda's battle with Englishman James Hunt, Lauda had grave concerns about race conditions as well as timeliness of rescue squads for the N-ring on that Sunday. Just like the nearby Belgian track at Spa, the climate was historically schizophrenic between wet and dry to the point the GPDA took a vote on whether they should drive or not and Lauda's vote was among the "No" but that position lost by one vote. On the second lap, an unspecified suspension failure at the very fast Bergwerke Curve (depicted by the yellow arrow in image to the right) sent his car into the right side embankment and then his car careened back onto the track where it was struck at high speed by another car driven by American Brett Lunger causing Lauda's vehicle to burst into flames.[433] Three other drivers came upon the scene and observing the very dire situation of Lauda still seated in his

Fig. 4-12: Location of Niki Lauda's 1976 crash that effectively ended the presence of N-ring on the F1 calendar. The yellow arrow near top of image points to site of Lauda's high-speed accident. Twaronite, *Nürburgring Nordschleife*, p. 18

433 Since the technology of on-board sensors had not yet been devised, post-crash inspections sometimes could not identify exact causes and this was one such occasion.

burning car they, with Lunger's help, tried to extinguish the intense inferno with a single small extinguisher as they extracted him and laid him on the track. Clearly the alternative would have been worse, yet in the one minute he was trapped in the burning wreckage he had third degree burns on his head, ear, and hands plus damage to his lungs and blood from inhaling toxic smoke. In the recent movie RUSH there is a very graphic scene as doctors intubate his lungs to remove burned scar tissue.[434] To this day he is thankful that he has no memory of the accident but it truly validated his "no" vote. This incident was the death knell for the N-ring to be on the F1 calendar. It was simply too big, too fast, too hard to support medically, and too dangerous for this series. However, it continued to be used for a variety of other, slower, series as well as factory testing plus individuals who could pay and test their car and skills at their own peril – which did happen. The N-ring is the only track with continuous testing for times since the 1920s by car companies.

[434] Ron Howard, "Rush," (Universal, 2013).

4.8 DAYTONA

Fig. 4-13: Daytona Beach. Long, hard, and flat, the beach provided optimum surface for high speed time trials. Personal photo.

The city that is currently known as Daytona Beach was originally just Daytona when incorporated along the Atlantic Intercoastal Waterway in 1876. By 1926, the area had grown in population such that the cities of Seabreeze, Daytona, and Daytona Beach were integrated and re-incorporated as Daytona Beach.[435] World famous for its hard, white sand, speed trials for automobiles began in 1903 with England's Sir Malcolm Campbell piloting his Bluebird in 1935 to an unsurpassed 276.82 mph. Unlike the previously highlighted circuits, this region was known as a destination for speed enthusiasts with the time trials and the automotive beach/road racing, but it was also a destination for beach-goers, fishermen, and boaters. Thus it should be no surprise that Bill France decided that his young family's journey from the northeast to Miami would end at Daytona.

France had driven in races up north and continued from his new base plus he began promoting races. These experiences led to his presiding over a gathering of almost 40 men

[435] "Daytona Beach," in *The New Encyclopeadia Britannica*, ed. Phillip Goetz (Chicago: Encyclopeadia Brittanica, Inc., 1988). Page 926, c

over the period December 14-17, 1947 at the Streamline Hotel on the A1A highway along the beach.[436] Those men were among the most important and respected people from across the country and local authorities to hear his proposal for a unified stock car racing (hereafter as SCR) entity under the banner, as voted upon, of NASCAR with him at the helm. The inaugural race for this nascent organization was February 15, 1948 on the road/beach course at Daytona Beach. In conducting research for this dissertation a significant point was impressed upon this author regarding commentary from the environmental historian J. Donald Hughes and its relevance is important here. In his book *What is Environmental History?* He devotes a salient chapter to "Thoughts on Doing Environmental History" where he challenges that field to, "If at all possible, see the place."[437] He further acknowledges that *in situ* does not equal *in tempus*, nonetheless one can "get a sense of how things must have been."[438] The learning experience here was how the wind was much more powerful at the beach-side locations than expected, how narrow the connectors between road and beach were, how implausible it was that such a competition should have been yet they conducted the races in the sand nonetheless.

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[436] Branham. Page 63
[437] JD. Hughes, *What Is Environmental History?* (Malden: Polity Press, 2006). Page 119
[438] ibid. Page 120

Fig. 4-15: Compendium of personal photos at different locations on the original beach/street racing space as shown in the archival photo from 1955.

Even before that inaugural race, Big Bill knew that the road/beach course would not last more than a few years and began thinking of a plan for bigger and better facilities with one of his inspirations being the massive iconic 2.5-mile Indianapolis Speedway. In part this perception was due to its global recognition as the ultimate racing venue and in part because when he attempted to race there in 1954, he was rebuffed as not having appropriate credentials. Having been asked to leave the speedway by AAA officials, he merely accepted it as their bias against NASCAR and its competing for a slice of the auto racing pie. Indeed, as Branham writes, "The Midwestern racing establishment's prejudice against what was viewed as a crude redneck circuit showcasing many past and present moonshiners, plus assorted others from the Deep South, cannot be exaggerated."[439] In fact, there was considerable merit to this belief and it is crucial to understand how it is situated with the construction of the Daytona Motor Speedway. Many of the early drivers in NASCAR were somehow involved in the distribution of illegal alcohol also known as moonshine which was quite profitable and easy to distill. These men were skilled mechanics and very adept at driving fast across the Piedmont and Appalachian mountains and valleys. They came from poor households that were either isolated deep in rural areas, at the end of a forested yet desolated hollow which is colloquially known as a "holler", or part of a mill town, and were indeed rough and rowdy with minimal formal education. They had few prospects for the future beyond continuation of the lives their parents had, although a few did venture beyond their seemingly bounded existence like Peter R. Moody. He attended Wofford College where he wrote a free-style poem for class assignment that was published in the April 1936 Wofford College Journal and sparked statewide political and

[439] Branham. Page 99

cultural controversy. In the end it was a very short-lived issue once all of the facts were known and he was declared by a medical doctor to not have been insane, but for that brief time it was a roiling tempest in the North Carolina teapot. In his book *Fabric of Defeat*, Bryant Simon shares the entire piece titled "To a Cotton Mill Worker" and depicts it as, "a searing saga of physical and intellectual degradation.[440] It was a lengthy and stunning rebuke of circumstances faced by a "linthead" as workers in the mill town of Cooleenee, NC were pejoratively labeled. Having grown up there this work decried awful conditions ending with, "What could you know about anything? You are dead! You died on your 16th birthday when you went to work in the cotton mill."[441] Two decades later, in the 1950s conditions were somewhat better until the market for exports began shrinking and the amount of imported goods increased. Places like the Crown Cotton Mills Company in Dalton, GA profiled in Doug Flamming's book *Creating the Modern South* ceased existence and sold its mill village which ended the last vestiges of a paternalistic living arrangement.[442]

These locations and conditions were the breeding grounds for young men desiring to uphold a "popular southern male ideal…called 'hell of a fellow'"[443] Pierce draws upon a few other authors for help in explaining this term which, synthesized here, meant a demonstrated virility, cheering lustily, wagering wildly, losing defiantly, chip-on-the-shoulder swagger, ready to fight, heavy drinking, sense of freedom and lack of dependence on others. These traits, "proved one's manhood, one's worthiness, to be accepted by

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[440] Bryant Simon, *A Fabric of Defeat: The Politics of South Carolina Millhands, 1910-1948* (Chapel Hill: The University of North Carolina Press, 1998). Pages 174-176
[441] Ibid
[442] Doug Flamming, *Creating the Modern South: Millhands & Managers in Dalton, Georgia, 1884-1984* (Chapel Hill: The University of North Carolina, 1992). Page 280
[443] Pierce. Page 22

peers.[444] One path to leaving the circumstances above was learning how to repair equipment in the mill or cars thus they turned to racing as either drivers or mechanics initially. This was the racing community of early NASCAR. But there was more to this community and it was positive as illustrated by two examples, one well known and the other lost in obscurity of archived and yellowed pages. [445]

Ben Shackleford states it succinctly in his dissertation that, “If enthusiasm, long hours, and danger set racers apart from society, it also helped bind racers together.”[446] First, this fraternity was found in the temporally unusual relationship between Wendell Scott and most drivers, to include the top names in the sport. Scott was African-American in 1960s segregated America and in a southern, white male, hell-of-a-fellow sport. Certainly he faced any number of insults and verbal abuse by spectators and the odds were stacked against him such as, for instance, at one venue he was not allowed to race until a “colored” ambulance arrived.[447] Yet among the racing fraternity he was highly respected for his mechanical skill in setting up cars and for his clean, skilled driving abilities. He was almost seen as an equal even among such highly praised men like Richard Petty, David Pearson, Joe Weatherly, and Cale Yarbrough – which account for 13 national championships among them.[448] Scott was indeed a very qualified and successful driver who won a race over a ten year career and four of those years saw him among the top ten in points (thus earnings)

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[444] Ibid

[445] As an example of how in-tune the community and the local populace was to the event. Staff, "Petty Vs. Weatherly: How It Happened," *The Sunday News Journal*, February 23 1954. Volusia County Library.

[446] Shackleford. Page 187

[447] Pierce. Page 241

[448] Shackleford. Page 194

with 1969 as his best year with more than $47,000 (which is approximately $326,000 for 2018) in earnings.

The second example of the bonds among the racing fraternity as part of the larger national community of active and enthusiast participants – more so these two than with the administrative participants – is an example of community or village. Deep in an archived collection at Appalachian State was a seemingly innocuous, yellowed journal image from January 1953 with a letter to the editor about a missing 16-yearl old boy. Why is this worthy of exploration? It is illuminating because it typifies the very nature of a community or, as a very well-known aphorism explains that "It takes a village to raise a child". A cursory analysis, based on this author's previous professional training, leads to a few presumptions. The requestor is the Commissioner of the California Highway Patrol on behalf of parents from Minnesota which would lead to the belief that the boy was very interested in cars and more specific hot-rods and dragsters as those were proliferating in 1950s California. The

Missing Person

EDITOR, SPEED AGE:

Here is a photograph of Roger Smith. He is 16 years old, 5 feet, 10 inches tall, fair complected, 130 pounds, blue eyes and sandy hair.

We have received a letter from his parents asking our help in locating this boy. It will be appreciated if you will publish a request that he return home, or at least call his parents.

Any information regarding this boy should be forwarded to Mrs. Fred Smith, 1760 North Dunlap Street, St. Paul, Minn.

—CLIFFORD E. PETERSON, Commissioner, California Highway Patrol, Sacramento

A True Sportsman

EDITOR, SPEED AGE:

Fig. 4-15: Missing person letter to editor. "Help wanted" ad to find 16-year old M/S enthusiast boy. Courtesy Appalachian State University, Stock Car Racing Collection, "Speed Age", January 1953, p. 4

periodical Speed Age was read not just by people enjoying those endeavors but also by specialty equipment manufacturers where a young man might go for work. There are many other factors and aspects but the point is made. Furthermore, this plea for help can be seen as a precursor to what is now a well-known “milk carton” campaign announcing lost children that began in the 1960s continuing in various formats today. This was the true community, the racing fraternity that needed a new race space in the Daytona area.

As mentioned above, Bill France began contemplating a newer site for the annual season-opening race in Daytona because typically the weather is clear, dry, and comfortable. While the beach spectacle was always appreciated by enthusiast participants for elements of calamity and unpredictability as well as its challenge to active participants, it had a short shelf-life as area growth increased. Whereas France publicly broached the idea of a new speedway in the Spring of 1953, it would require several fiscal and legislative maneuvers over several years. First and foremost was site selection which, in the end, was a large tract of swampland next to the Daytona airport as analyzed for an op-ed in the Daytona Beach Evening News on September 5, 1955.[449] It was essentially agreed that a superspeedway would be coming to the area. It is also informative to understand the perspective of the area’s inhabitants when effected by major change to the physical community and another op-ed from 1957 provides more insight into this window as it relates to the collapse of the bond market. It offers a longer and more positive strategic outlook.[450] In November 1953,

[449] Staff, "Putting Wild Land to Work," *Daytona Beach Evening News*, 9/5/1955 1955. Volusia County Library.
[450] "What the Speedway Plans Mean," *Daytona Beach Evening News*, 11/11/1957 1957. Volusia County Library.

Volusia County began improvements to meet future traffic needs. In 1954 local officials created a special District and the power to sell tax-free bonds for the track's construction[451].

The next year the city "approved a ninety-nine year lease on a 377-acre tract near the airport…[Simultaneously]…Bill France created the Daytona Beach Motor Speedway Corporation" for its construction, operation, and leasing from the District.[452] With the 1957 collapse of the bond market, a series of unrelated events led France to have a conversation fellow aviation enthusiast, the wealthy Clint Murchison who owned the new Dallas Cowboys NFL franchise. That subsequently was led by Murchison financial adviser, Howard Sluyter visualizing a profitable business arrangement writing France a personal check for $20,000 and helping secure a $600,000 loan for Big Bill.[453] This funding occurred <u>after</u> France signed a fifty-five year lease with the District and had issued 300,000

Fig. 4-16 (a) and (b). Construction of banking at Daytona: On the left is the formation of 30-degree banking with hopper in 1958. On the right is the finishing paving process in 1959. Note the difficulty for man in center to stand. Courtesy ISC Archives

[451] The district name was "Daytona Beach Racing and Recreational Facility District"
[452] Pierce. Page 198
[453] ibid. Page 200

shares of stock at one dollar per share in the Daytona Beach International Speedway Corporation.[454]

Work on the new superspeedway began in November 1957 with the first action to begin controlling the water from the swamp which eventually became the 45-acre Lake Lloyd and situated inside the tri-oval race space.[455] Actual construction began in the Spring of 1958 with dirt being bulldozed to form the 31-degree banked turns which was the steepest grade possible before gravity would prevent the dirt from remaining in place. This

extreme angle was unprecedented, especially for heavy cars travelling almost 200-mph. In his vision of designing the speedway with a bowl-like configuration, France wanted spectators to have virtually unobstructed views of action anywhere on the track. For a 2.5-mile tri-oval it was unlikely to see anywhere without the use of binoculars but that was not a major concern. This was a novel approach toward a fuller experience and would be emulated in all future oval tracks built and re-designed.

The actual science of building this massive facility can be thought of in the same way as the requirements for the mathematical concept of the Clothoid curve for the RAB in Nazi Germany. For the RAB it was a matter of gently blending speeds between highway and road, while for the Daytona superspeedway required, "an engineering approach utilized during railroad expansion in the 19th century" known as a transition spiral.[456] The important take-away from this construction was about how people tapped into the breadth of the

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[454] This became the International Speedway Corporation (ISC) which still owns Daytona plus more than a dozen other speedways.

[455] It was named after auto-dealer Saxton Lloyd who was the head of the District and also France's first employer in Daytona Beach.

[456] Branham. Page 101

knowledge base. In France's quest to construct this comparatively gargantuan racing complex, he knew that its completion would require assistance from several quarters. One lynch-pin individual to successfully organize this task was Charles Moneypenny, and engineer with the city of Daytona Beach. With the uniqueness of this particular venue in terms of the physics of space and speed it was necessary to reach out beyond the local knowledge base. Being open to any source to complete the project, Mr. Moneypenny contacted Harley Earl at General Motors (introduced in earlier chapters) who "allowed France and Moneypenny to tap into GM's computer expertise to design the unique turns of the track."[457] In seeking the broadest possible foundation upon which to build this facility, he also reached out to GM's most hostile competitor, Ford Motor Company about translating that company's test track construction data and incorporating this into the Daytona race space.[458] These very complicated scientific equations which had never before been attempted. Anticipating other racing series such as WEC and other road racing series, the construction added race space throughout the infield yielding a 3.81 mile circuit when added to the banked 2.5 mile oval.[459] The initial event supported by this aspect took place on February 11, 1962 which lasted three hours and later became the Rolex- sponsored 24-Hours of Daytona as the American partner to the *24 Heures du Mans* at LeMans, France.

Formation of this venue continued through 1958, as racing continued on the road/beach course albeit with larger and more powerful cars. At the last Grand National race on this course were a spectacular *caramboulages* like the one depicted in the image below between

[457] Pierce. Page 199
[458] Branham. Page 101
[459] D. Oliver, Mormillo, F., *Great American Race Tracks: A Panoramic View of the Top Autorace Circuits Coast-to-Coast* (Edison: Chartwell Books, 2005).

two of the best drivers attempting to defy the laws of physics in occupying the same space at the same time.

In addition, important planning was underway on operational and infrastructural requirements such as law enforcement, medical facilities, etc. so one of the sources they drew upon for expertise was the Indianapolis Speedway. In the planning of these requirements, the need for an official camera at the start/finish line was overlooked and was sorely missed in determining the inaugural race winner as will be shown below. The end result of Bill France's dream came to fruition with the inaugural race held on February 22, 1959, It was evident even before the green flag that this new facility was to be respected because on a practice lap, experienced driver Marshall Teague ignored the warnings from future Hall-of-Famer (HOF) Smokey Yunick of instability at those higher speeds. He pushed the limits of car and track ultimately paying with his life. In the words of another HOF driver, Lee Petty (father to Richard Petty) on racing at Daytona, "I'll tell you what, there wasn't a man there who wasn't scared to death of the place."[460] As such, the inaugural 500 mile race had no caution flags, as in no accidents and one factor for this highly unusual occurrence of no accidents was the uniqueness of the types of entries. Of the 59 cars that started the race, there were many convertibles as a special category but that category would never return as it was just too dangerous. Nonetheless, the finish was befitting of Bill France's desire for the spectacular and many conversations would last beyond the Sunday night news.

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[460] Pierce. Page 200

Unintentional design techniques in the creation of this tri-oval, enabled the use of an aerodynamic phenomenon known in M/S as “drafting” and “slingshot” because of the high speeds. Particularly effective and visible in American stock car racing (SCR) due to the large blunt-nosed shape at the front of Detroit cars, they “punched” large holes in the air and that diversion of airflow would continue both over the first car and the one behind it and at Daytona speeds, even the third car in line. In the prevailing slipstream a vacuum formed which sucked in the second car whereby that driver could let-off on the accelerator and simply draft in the vacuum. At an opportune moment at the choosing of the second car’s driver, he would simultaneously pull out from behind the first car and completely push the accelerator to the floor thereby slingshotting past the first car whose driver could do nothing to prevent this action. Daytona was the first race where driver’s experienced this phenomenon thus they had to learn the feel of this technique during the race and refine how to use it over the entire race. This is what occurred between the last turn and the finish line with Johnny Beauchamp and Lee Petty resulting in what became know as a photo-finish. However, without an official camera at the finish line there was no proof of who the victor might be. Lee Petty proclaimed his victory without evidence and France did not intervene realizing that he had national media attention that would be priceless. He did announce in the interim that he would seek conclusive evidence which he eventually did after consulting many media members with Petty barely in front of Beauchamp. As Pierce elucidates, “France had effectively manipulated the media and the American public and kept the race in the national limelight for four straight days and permanently stamped an image of the dramatic finish in the American psyche.”

4.8.1 THE YEAR 1972

This year, as it related to Daytona and Hughes' concept of transfers in an LTS, saw two huge transfers. The first was funding and sponsorship for NASCAR as an entity and the second was transfer of power from Bill France, Sr. to Bill France, Jr. The former narrative about R.J. Reynolds Tobacco Co. has been well-articulated in previous chapters but must be acknowledged again here to re-situate and re-affirm its critical role of the growth and success of NASCAR.

The second event occurred on January 10th of that year when France, Sr. turned the reins of NASCAR to his son Junior. There was a difference in leadership approach and style between the leading edge, conceptual entrepreneur versus the skilled and consummate manager who would take a large organization to the next level of growth beyond its successful establishment at the time. Symbolically, with respect to NASCAR and the France family, this transfer of power enabled the separation of growing pains encountered by Senior from the possibilities and opportunities that Junior could explore. Pierce illustrates the success of NASCAR as of 1973 by outlining they had 16,000 members, competing at 80 different venues in six divisions for more than $6-million in prize money.[461] Bill France, Sr. had done his part as system builder leaving Bill France, Jr. with a solid foundation to expand the brand beyond the American southeast, and beyond the residue of the "hell of a fellow" mantle that had been wrapped around their axles.

[461] ibid. Page 291

4.8.2 THE FIGHT

Finally, it would be a gross error to omit what, among all American M/S participants and many across the globe, is simply known as “The Fight”. In NASCAR, the most important event is not the finale, it is the commencing of the season. It was Bill France’s way to take a different tact in M/S and this dramatic season-opening festivity was the Daytona 500. Throughout the 60s and 70s NASCAR races had only been televised in edited snippets on a sporadic basis but as interest grew, purses grew, drivers evolved from the rough early pilots to a new breed that was more polished and professional, major corporations were sponsoring cars, France made the case for “live” flag-to-flag broadcast of at least the Daytona 500. The result was an agreement that the American broadcaster Columbia Broadcast System (CBS) would, in fact, show the Daytona 500 from green flag to checkered flag and it was the first ever complete airing of a M/S race. What France could not have predicted was how this one race changed everything that was NASCAR and beyond in terms of revenues and broadcast rights. In the same unpredictable way the inaugural race with Lee Petty immediately grew the enthusiast numbers, this race materially expanded interest beyond the southeast.

This endeavor required an enormous amount of new pre-race planning methods both by the network and the facility for infrastructure, logistics, personnel, etc. What made this spectacle even more unique and technologically challenging was that it would also see the implementation of a technique known as “in-car camera”. The host car was piloted by future hall-of-fame driver and eventual broadcast analyst, Benny Parsons with the deliberate intent of bringing the television audience into the car and, as best as possible on a two-dimensional screen, have the audience share the experience of being in the car at almost 200-mph on flat pavement only to be hurtled onto 31-degree banked turns twice per lap and 200 laps. For its time it was ambitious and effective in that no viewers had any idea how severe this was.

To have a captive audience on a national level for approximately four continuous hours was a dream for any sponsor or advertiser. The revelation that a company or product would be constantly seen by a fair percentage of the national consumer base was met with trepidation by some as NASCAR was *in tempus* still perceived as a regional southeast activity, and by others as an enormous opportunity for growing its sales volume and market share.[462] In modern economics literature this time a car is on screen is referred to "value of time on camera (VTOC)"[463] and as it implies, the more camera coverage the better for the sponsor. Typically the better the driver, the more VTOC is likely. There was no other advertising avenue that afforded maximum VTOC.

The race itself was competitive and exciting to watch and not only because of excited commentators and former driver analysts. In addition, television viewership numbers were higher than normal because of a snowstorm in both the Northeast and the Midwest thus a captive audience as millions of people were snowed-in. While the action on the track throughout the race kept viewers enthralled, it was the ending which cemented this race and eventually NASCAR as an entity worth watching for enthusiasts and sponsoring for corporations. As the race was nearing an already tension-filled atmosphere, it was evident that adrenaline was fueling the drivers up front. On the final lap, after 498 continuous miles

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[462] A. Abere, Bronsteen, P., Elzinga, K., "The Economics of Nascar," in *The Oxford Handbook of Sports Economics*, ed. L. Kahane, Shmanske, S. (Cambridge: Oxford University Press, 2010).
[463] Rotthoff. See also, Pruitt.

driving heavy cars with no power steering or power brakes and near exhaustion, drivers Cale Yarbrough and Donnie Allison were side-by-side quite literally banging into each other. The net effect was they spun each other across several hundred yards of infield turf coming to rest inside the apex between turns three and four. They exited their cars and while they began arguing Richard Petty continued around for his sixth Daytona 500 victory. In the meantime, Donnie's brother Bobby joined the fracas which eventually became physical. After Petty had crossed the finish line, the CBS control booth realized there was a commotion and turned their cameras onto the belligerents. The literature of M/S and sports in general has described the event as one of the turning points catapulting NASCAR to interest groups beyond just the southeastern United States. The breadth of racers attempting to leave behind their "hell of a fellow" heritage was disturbed that day yet this event was important because: 1) the trio made up the next day, paid their $6,000 fines, and have been good friends ever since, 2) to many it was emblematic of the hard-nosed American pugnaciousness in pursuit of success, and 3) it was seen, beyond pursuit of success, by the viewing public as individual drive and competitiveness to which they wanted an association or relationship. As for the television networks, they cautiously increased the number of races shown until entire seasons would be televised beginning in the next phase.

The Daytona superspeedway was a remarkable inclusion in the M/S competition of NASCAR and WEC and was the locus of many innovations and "firsts". It was the first fully closed-loop superspeedway enabling previously unattainable high-speeds reliant upon the exceptionally steep 31-degree banking. It was the first to enable spectators to have a nearly unobstructed view of the entire circuit. It was the first venue to have been reclaimed from swamp-land to become a viable and competitive race space. I was the first to host live, flag-to-flag, as well as in-car-camera, coverage of a major SCR event. From the incredulous beach racing to the high banks of the superspeedway, Daytona is synonymous with speed and evokes for any participant category an appreciation of respect, skill, innovation, and effort.

4.9 CONCLUSION

The two decades of this phase were indeed about transfer (and not only technology transfer), transformation, and regional clusters. For open-wheel racing the epicenter for all things technological departed northern Italy's Motor Valley, for central England's Motor Sport Valley.[464] For NASCAR, the locus shifted from numerous regional centers in America to become centralized around Charlotte, NC. Across these relocations of mechanics and engineers traded knowledge they had acquired over time as they too moved across the special communities which applied scientific principles, bringing their tacit knowledge was then combined with exposure of new techniques, regulations, and problems. This resulted in a plethora of innovative ideas from many sources in the teams of which some were successfully put into practice and retained like aerodynamics and downforce while others were banned in application like fans and thin-strut wings of the 60s.

Yet, this era was also about other transfers. In this period it was also a transfer of power through the co-produced hegemony practiced by Bernie Ecclestone and Bill France. For BE the power ranged across all three of John Kenneth Galbraith's instruments of power:

[464] Jenkins.

Condign, Compensatory, and Conditioned. He strengthened the position of FOCA members by strong-arming multiple negotiations thus supplanting FIA being in control of F1 with himself in charge. For France's power over NASCAR, it began as condign, became compensatory in the 70s, ultimately through conditioned power. For F1, the formation of the GPDA meant some power transfer occurred and was wielded in the form of boycott votes refusing to race at some tracks for safety purposes. The same did not work for the NASCAR as those GPDA efforts were stillborn. It was evident that, based on actions by both men, they believed there could only be one person in charge. Pierce adds from a contemporary interview of France's primary partner, Bill Tuthill, during the Streamline Hotel meeting, "I told Bill [France] that the democratic method, where the board voted on everything[,] had never worked."[465]

Transfer of power also took place with respect to safety. For NASCAR, drivers did have somewhat of a voice that resulted in the change from single layer Armco barriers to, by 1966, its replacement by concrete which prevented cars from vaulting over guardrails. For F1 (and later the WEC and FIA), power was taken away from circuit staff by BE and placed solely in the hands of Dr. Sid as a result of many tragic fatalities in the 60s and 70s but the lynchpin was their direct involvement in the after-effects of the fatal crash of Ronnie Peterson in 1978. One of many direct outcomes was the implementation in 1980 of 'Fastcar' rescue vehicles, and the first-lap chase vehicle with trauma staff on-board.

The early 60s to early 80s also saw the transformation of culture in both F1 and NASCAR. One example for F1 in addition to the safety perspective was the involvement of women in

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[465] Pierce. Page 100

the teams. One of the most important activities on a M/S team was to correctly gather lap time data. Throughout those years, this function was fulfilled in most cases by girlfriends, fiancés, and wives until the technology of electronics superseded their skillsets due to faster and more accurate (to the thousands of a minute) results. In NASCAR, the culture transformed from a rough and rowdy "hell of a fellow" character in the early 60s to a more polished and professional driver in the late 70s – barring one glaring and nationally televised example.

This era also experienced the massive transfer of funds in that during the late 60s advertising (predominantly tobacco) was allowed in F1, and in 1972 RJR began sponsorship of NASCAR. Thus began an uneasy and highly controversial relationship between M/S and tobacco. Although it was primarily **because of** this enormous injection of capital that teams were able to embark upon their internal practical application scientific R&D and the resultant innovations.

Finally, those years were transformative times also because heavy contemplations akin to Alvin Gouldner's "Reflexive Sociology" set in motion the removal of three iconic circuits from the F1 calendar. In Gouldner's notion he remonstrates that his profession of sociologists was, "No more than others are they ready, willing, or able to tell us what they are really doing and to distinguish this firmly from what they *should* be doing."[466] For M/S this meant making hard decisions about truly iconic road courses. Both Spa and N-ring became too expansive and too dangerous to remain on the calendar unless corrective changes were made. Efforts to abide by the new safety requirements were attempted by

[466] Alvin W. Gouldner, *The Coming Crisis of Western Sociology* (New York, London: Basic Books, Inc., 1970). Page 488

both with different outcomes as will be outlined in the next chapter. WGI suffered from both safety and financial ills and would never return to the F1 schedule.

CHAPTER V: SYSTEM GROWTH AND CRITICAL PROBLEMS – EARLY 1980S TO EARLY 2000S

As a system grows, it is presented with a myriad of issues to resolve. In using the phrase reverse salients, Hughes chose this military term to indicate how as an army moves forward, some elements were less successful than others.[467] Methods used in M/S to prevent being left behind were to be nimble and ready for change whether forced by new regulations or reacting to a competitor's innovation as well as by implementing intelligence gathering by team members and carefully listening to overheard conversations in the paddock area. As former F1 champion mechanic and engineer Steve Matchett writes, "All the teams constantly watch each other, all on the lookout for any slight advantage that they can employ themselves."[468] In other words knowing your competition, or as the ancient strategist Sun Tzu proclaimed, "If you know your enemy and know yourself, you need not fear the result of a hundred battles."[469] This was successfully practiced by some teams but not all teams which resulted in relatively short appearances by some teams of only two to four years as discussed by analysts during race broadcasts.

In situating the chapter from the early 1980s to the millennial turn there were certain macroeconomic and socio-political events which greatly impacted M/S and especially F1. This examination will concentrate on particular iterations of massive change for the

[467] On grand war strategy and reverse salients see, Carl von Clausewitz, *On War*, trans. Michael & Paret Howard, Peter (New York: Alfred A. Knopf, 1993)., especially chapter 15. On unit level tactics and reverse salients see, Erwin Rommel, *Attacks* (Athena Press, Inc., 1979 (1937)).
[468] Steve Matchett, *The Mechanic's Tale: Life in the Pit-Lanes of Formula One* (Orion, 2000). Page 109
[469] Sun Tzu, *The Art of War* (New York: Delacorte Press, 1983 (5th Cent. BCE)). Page 2
These immediate three works are required reading for US Army officers in the combat-arms branches (Armor, Artillery, and Infantry) with Clausewitz at mid-to-senior officer levels, the latter two at junior to mid-level.

automotive industry on both method of producing them and how the constituency of participants were impacted. Remaining with automobility during this phase, environmental concerns of Europe were addressed in a seemingly disjointed and out-of-cadence approach to emissions and almost twenty years after the United States. Following that section will be a discussion of technological efforts to decrease lap times plus technical changes to the existing tracks and requirements for building new ones as both F1 and NASCAR expanded their domains while the men who had grown them expanded their control of media distribution of what had become a highly desired genre of entertainment worldwide. Finally, this chapter will reveal the growth, temporary demise, and re-birth of the respected circuit known simply as, Spa.

5.1 THE MACROVIEW

No twenty-year period without war at a supranational level (as opposed to "by proxy") could match the preponderance of monumental transformation that occurred in the previous two chapters. Passenger air travel advanced from the tri-tailed propeller driven Lockheed Constellation to the two-tiered bubble-topped Boeing 747 quad engine jet.[470] Auto travel transitioned from the rare power-assist feature to the ubiquitous driver-assist/comfort "power-everything" with air-conditioned interior. Personal communication for rural areas migrated from reliance on switchboard operators manually inserting cables/jacks into specific connectors to rotary dial phones and then push-button Slimline™ from the regional Bell operating company (aka: RBOC) and ultimately cell phones.[471] These exemplars

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[470] Author and family were passengers on the inaugural October 1970 Pan Am flight using the new 747 equipment from New York's JFK to Brussels, Belgium. It did not begin well but ended smoothly.

[471] Sally H. Clarke, Naomi R. Lamoreaux, and Steven W. Usselman, *The Challenge of Remaining Innovative : Insights from Twentieth-Century American Business*, Innovation and Technology in the World Economy (Stanford, Calif.: Stanford University Press, 2009).

merely scratch the surface of the exponential differences for ordinary users of technologies and do not reflect a fraction of the enormous technical changes that transpired among the more sophisticated realms of financial, manufacturing, and, of course, M/S industries. There are four areas germane to automobility and M/S which are the Maastricht Treaty of 1992, the complete re-tooling of automotive production processes and the operational labor that went with it, the fall of Communism, and the troubled European efforts at adoption of a cohesive approach to controlling air pollution from automobiles in concert with the controversial *Waldsterben* (forest death).

To begin, the 1992 Maastricht Treaty was incredibly complex with respect to European Union (EU) endeavors and in its entirety is well beyond the purview of this document. A comparatively simple explanation for relevant purposes here is that it established a regulatory process to ensure competitive fairness and equanimity for any transactions taking place in the embryonic EU.[472] Almost a decade after its signatory completion this would become an issue, that is to say, obstacle, in the F1 schedule to be illuminated below.

The second aspect of this broader historical landscape was the wholesale repositioning of labor and production in the manufacture of automobiles and the effect it had on enthusiast participants. In chapter three above, the disastrous divergence from highly manual to more automated methods such as what took place in Lordstown, Ohio with General Motors were revealed. Efforts by car-makers to continuously upgrade production techniques to satisfy ever-shrinking efficiency targets became mandatory across the industry. The first cut was to replace some people on the assembly line with technology. The belief was that robotic

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[472] Moravcsik. Chapters 6 and 7. Judt. Pages 716-717

or mechanistic movements would be performed more accurately, efficiently, quickly, and safely than a human as well as eliminating the potential of workplace repetitive injury claims. This further drove down the cost of production but as a consequence quality suffered in Western auto plants. In the early 1980s, Japanese cars were increasing in their reliability ratings and also getting better gas mileage as fuel cost had been increasing which placed intense scrutiny on American makers as they had the most market-share.[473] Over the course of this entire epoch Detroit, as the locus for the headquarters for the "Big Three" brands (Chrysler, Ford, and GM), was abuzz about Japanese manufacturing techniques like *Kanban* that began in 1950s Japan for Toyota, and then the *kaizen* method that became the elusive *sine qua non* for making cars in particular but also anything else that was made on assembly lines.[474] But this manufacturing ideology was markedly disparate from western or American philosophy and seldom took any meaningful hold. They also reviewed a Swedish model for Volvo cars but that was short-lived as too inefficient and expensive.[475] By 1990, MIT researchers ascribed the term "lean production" to the process of just-in-time manufacturing whereby parts/inventory did not sit idly for too long.

However, there were problems for enthusiasts participants with these approaches. First of all, in the United States, it was the de-skilling and replacement of people who enjoyed M/S, – members of the powerful United Auto Workers union (UAW) – by computers and "mechatronix" equipment.[476] In Europe there was a huge chasm in the skill and experience

[473] Gartman. Pages 217-218
[474] David Nye, *America's Assembly Line* (Cambridge: MIT Press, 2013). Page 196 for *Kanban* (the use of colored cards to " indicate assembly sequences and to keep track of inventory"). Page 199 for kaizen ("continuous improvement through employee participation in a process-oriented corporate culture.")
[475] Ibid. Pages 183-184. "Instead of a moving line, cars stood still much of the time, while teams of workers built them." This was, in essence, a high-tech reverting to pre-Fordist methods although worker turnover decreased.
[476] On computers replacing and de-skilling people see, Noble. On "mechatronix" see, Mowery.

of newly “liberated” workers from eastern Europe. Their workplaces at communist manufacturing facilities had not been exposed to the vast amount of changes and advances in methods/techniques as their western counterparts. Thus they were not accustomed to the pace of long established demands of western work rates even as reasonable as those demands were in comparison to American labor requirements. Furthermore, across these years there was a shift from manual individual workplace skills to a need for more informational interpretation of data taking place.[477] In paraphrasing Hobsbawm, “The illusion of a collapsing working class was due to the shifts within it…[and]…the rise of occupations which required secondary and higher education.”[478] The malaise felt by the average worker did not mirror the euphoria of the high-flying financial risk-takers during segments of the 1990s. This malaise extended itself over to the enthusiast participants and the cars they drove with an almost *film-noir* despondency at the dullness of design and tepid performance. Enthusiast participants were choosing not to purchase their usual American or European cars but instead were acquiring Japanese cars in greater quantities. This impacted car makers and their contributions to M/S.

What is difficult to reconcile in the European car industry was the bifurcated messages and approaches toward design and production. During these decades European auto designers cast a long shadow of creativity in one direction with a plethora of radical offerings that never appeared in full-scale production mode yet the full scale production models were, to turn an unimpressed phrase, okay.[479] Likewise, in America it was a schizophrenic period

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[477] Peter Hall, "Forces Shaping Urban Europe," *Urban Studies* 30, no. 6 (1993).
[478] Hobsbawm. Page 302 for first part of quote and page 295 for second part.
[479] Gregory Janicki, *Cars Europe Never Built: Fifty Years of Experimental Cars* (New York: Sterling Publishing, Co., 1992).

for the auto industry but for the enthusiast it was tepid as car designs were still struggling to incorporate the "bumper" requirements into some semblance of style yet the end result began to appear to have a "cookie-cutter" similarity in more aerodynamic shapes than the past which has continued to designs of the current day. However, there were two new entrants upon the automotive landscape – SUV's and the Prius.[480] This was another factor in participants not buying car brands they had been loyally ordering in years past.

The first was the rise of the Sport Utility Vehicle (SUV) beginning in the mid-1980s as Detroit initiated an effort for an entire auto industry work-around to side-step a variety of regulatory statutes for emissions, fuel, and safety. As McCarthy states, "The SUV emerged as the great new alternative."[481] There are multiple tropes elucidating the evolution of the SUV and its relationship with Detroit manufacturing lobbying for policy exemptions for categorization (truck, car, other?), safety enforcement, and fuel mileage. What did occur was a hugely unexpected sales volume increase as Americans, typically early adult males, sought these vehicles for either "reptilian desire for survival" in dangerous driving conditions, or off-road fantasies that would either take place or go unanswered in their lives.[482] More importantly, enthusiast participants, with their SUV's, could all of a sudden transport more folding chairs, ice coolers filled with beverages as well as food they could now cook on their own grill which they could put into their SUV thus enhancing the tailgating experience at the race.

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480 James Dunn, *Driving Forces: The Automobile, Its Enemies, and the Politics of Mobility* (Washington, D.C.: Brooking Institution Press, 1998). Ladd. See also Seiler.
481 McCarthy. Page 235 As for the origin of the term SUV there are multiple anecdotal versions.
482 Ladd. Reptilian quote on page 181.

The second was the hybrid Toyota Prius in 1997 which had a much more passive debut despite the major emphasis on its technology and capabilities. Distinctly an advantage for urban transportation it was not conducive for long-distance ventures as its process relied upon the kinetic energy of braking to replenish the stored energy in batteries for eventual acceleration. This technology will be detailed in the M/S section further below but it was nonetheless a radical departure for car makers and the incredible pre-sales forced other large manufacturers to recalibrate their product lines and market estimations.[483] It would take into the next century for the other car makers to catch up with Toyota's market dominance with hybrid cars.

5.2 FALL OF THE IRON CURTAIN

In the mid-1980s cracks were forming, with Ronald Reagan's assistance, in the veneer that was the USSR's control over eastern Europe. Poland's Solidarity movement successfully challenged the state-run management of port operations in Gdansk and elsewhere. Hungary is important to the M/S story as it was, "the first Soviet-bloc country to reform its economy…First introduced in 1968, 'goulash communism' was a consumption-oriented variation of the command economy"[484] Like the ideological cracks which successfully formed in Poland with the Solidarity movement discussed earlier, once the writing was on the proverbial wall that some variation of capitalism was going to replace the experiences of the previous forty years in Hungary it, "embarked on more ambitious market-oriented reforms between 1989 and 1991."[485]

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[483] McCarthy. Page 250.
[484] Gillingham. Page 427
[485] Nicholas Stern, "Transition Report 1996: Infrastructure and Savings," in *The Economics of Transition*, ed. Phillippe Aghion (London: European Bank for Reconstruction and Development, 1996).

As it pertains to automotive culture, automobility, and M/S behind the Iron Curtain, Czechoslovakia was dominant in automotive competition. That might have been the product of a bifurcated representation by the state(s). Along the one path was the state-controlled manufacture of substandard eastern European cars like the 1980s East German Trabant with its plywood frame a la Ford Model-T from the 1920s and the slightly more substantial yet also inadequate Wartburg and the Russian Lada based on the small Italian Fiat four-door sedans among others.[486] All of these were devoid of safety, comfort, or technologically advanced features in keeping with contemporary modern cars in the West. Against this backdrop can be found a few sporadic entrees into auto rally events across the Soviet Russian space during the Interbellum but which never amounted to much beyond a short-term spectacle.[487] Conversely, the current Czech Republic (formerly Czechoslovakian Soviet Socialist Republic) was the home to successful Rallye competition manufacturers Tatra and Skoda. Tatra made sedan-type vehicles and they had been efficacious with innovative technologies and designs for use by the elites during this period until a decision to focus on trucks was made in 1999 and are still being produced today. As for Skoda they had solved the puzzle such that the company survived the spasmodic years of transition from planned-economy communism to a market-driven economy winning rally races and championships in the 20th century and remaining as a competitive brand in the current World Rally Championship (WRC).

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[486] For an interesting exploration into Communist car use and manufacturing see, Lewis Siegelbaum, *Cars for Comrades: The Life of the Soviet Automobile* (Ithaca: Cornell University Press, 2008). See also, Jonathan Zatlin, "The Vehicle of Desire: The Trabant, the Wartburg, and the Gdr," *German History* 15, no. 3 (1997).

[487] Siegelbaum. Pages 145-148

It was against this backdrop that Bernie Ecclestone (BE) negotiated for three years to include a Communist bloc space in the F1 schedule which would become the Hungaroring and the 1986 Hungarian Grand Prix. A notoriously difficult circuit upon which to pass a competitor, it nevertheless represented the extension beyond the western European colonial ideals espoused by the FIA leadership that M/S and F1 in particular, were the exclusive domain of their imperial and antediluvian view.[488] Yet it was BE who was to be proven correct because 240,000 spectators, mostly from the still communist eastern Europe, "arrived to experience western culture in a communist country."[489] On the dismantling of Communism, Vaclav Havel eloquently stated, "Communism was not defeated by military force, but by life, by the human spirit, by conscience, by the resistance of Being and man to manipulation."[490] This dissolution of "all things Iron Curtain" would also reveal some very troubling environmental conditions.

5.3 ENVIRONMENTAL TROUBLES

Enthusiast and active participants were becoming greatly influenced by environmental concerns and their relationship with, and support for M/S. In the edited manuscript *The Illusory Boundary*, James Williams invokes Mel Kranzberg and Carroll Pursell from their 1967 collaboration *Technology in Western Civilization, Vol. I*, "Technology, in a sense, is nothing more than the area of interaction between ourselves, as individuals, and our environment, whether material or spiritual, natural or manmade."[491] As this notation relates to the environment of late 20th century Europe it was becoming a tempestuous affair

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488 Hamilton. Pages 220-223 See also, Adas.
489 Bower. Page 145
490 Vaclav Havel, "The End of the Modern Era," in *Social Theory: The Multicultural and Classic Readings*, ed. Charles Lemert (Philadelphia: Westview Press, 2010 (1992)). Page 578
491 Williams. Page 16

because as J.R. McNeill reminds that, “The environment is a transnational actor and setting per se, transcending all political and cultural borders”[492] As elaborated upon in previous chapters, overtures were made toward minimizing environmental damage from cars since the mid-1960s in America with varying degrees of effectiveness. It cannot be ignored, however, that there was still a major issue of pollution from power and manufacturing plants on either side of the Canada/U.S. border.

In Europe it was distinctly more halting with the first international agreement being the 1979 Convention on Long-Range Transboundary Air Pollution (CLTAP) by the Member States of the United Nation Economic Commission for Europe (UNECE).[493] Indeed, Frank Ükötter explains the matter quite succinctly that, “The environmental boom of the 1970s had been mainly an American affair, with the rest of the world following up in often-lukewarm fashion.”[494] The reason that UN intervention and leadership was essential for that agreement was that it was truly an international and transnational matter in Europe because weather systems typically followed a west-to-east flow carrying western European Green-House Gasses (like vehicle exhaust) with it. International matters should be understood as issues between countries involving diplomacy whereas transnational matters are to be understood here as issues of the same type that took place in more than one country at the same time and require a more fine-tuned examination as to how responses differed or might have been similar/overlapping.[495] Furthermore, under the domination of the USSR, the eastern bloc countries, “focused the tools of their [excavation, utility, and

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492 McNeill. Page 15
493 Sliggers. Foreword by UN Secretary General Kofi A. Annan. Page iii For an in-depth discussion on transnational historical studies see, Bayly. See also, Sellers. Chapters 8 and 12 on transnational impacts.
494 Uekötter, "The End of the Cold War." Page 344
495 On transnationalism see, Turchetti.

manufacturing] trade on achieving high production targets and saw nature only as a commodity."[496] This observation is reinforced both by Tony Judt's remark that, "Under Socialism it was the state that polluted. But it was society that suffered" and data that indicated the Silesian and Bohemian regions of east Europe had the worst air pollution in Europe as of the early 1980s.[497] Deforestation from pollution was initially considered as having originated from Iron Curtain countries, however, in the 1980s, German activists were raising concerns of their own about *Waldsterben* (forest death) in eastern parts of the *Bundesrepublik*. The claim was indeed a real one which merited action but for some it became an extreme with the pronouncement that, "First the trees die, then the people", which Radkau exclaims how, "this has been used to ridicule ecological alarmism."[498] As late as 1996 the issue was still of great unresolved significance as indicated in a post-Soviet European transition report that, "Environmental degradation was pervasive in the old regime."[499]

Initial forays into European politics by environmentally focused groups began in the early 1970s without great success and while a large component of their criticism was anti-nuclear followed by manufacturing exhaust, poor air quality from cars was their other base. As these parties, which came to be known as the Greens eventually grew and started gaining seats in European country parliaments, their message about air quality began resonating with the M/S enthusiast participant and questions were being asked by them regarding

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[496] Paul Josephson, "War on Nature as Part of the Cold War," in *Environmental Histories of the Cold War*, ed. JR. McNeil, Unger, C. (Cambridge: Cambridge University Press, 2013). Page 23
[497] Judt. Pages 570-571
[498] Radkau. Page 272
[499] Stern. Page 5

solutions.[500] Through the efforts of multiple organizations and agencies in each country, the Luxembourg Compromise was initially crafted in 1966 and signed in 1987. Those efforts were not without contentiousness regarding changes to fuel/emission standards promoted by West Germany, France, and Denmark versus those proposed by countries less aggressive toward change.[501] This discontinuity stemmed from the fact lead content requirements were not standard across the continent thus "cars would not run well if refueled in a country where fuel specifications contained different lead levels."[502]

This was especially inconvenient on American military and government workers who moved to Europe to serve minimum three year tours from the late 1970s into the 1990s and elected to bring their Privately Owned Vehicles (POV's). Catalytic converters had been required on all American cars manufactured since 1975 which required unleaded gasoline because regular leaded fuel would have destroyed a converter. To prevent damage to the converter, or worse, service members were required to acquire a special Department of Defense form authorizing a professional garage to remove said device, then store it for the duration while in Europe. If it was not removed the owner risked a damaged unit or worse, the possibility of fire. When returning to America, the reverse process took place. This was a significant matter to American enthusiasts who wanted to travel to M/S venues across Europe.[503] The scarcity of lead-free was an issue until the late 1980s when it slowly became

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[500] Sliggers. Page 16, June 1984 UNECE conference in Munich, Germany; Page 135, November 1986 Convention Executive Body, Geneva, Switzerland

[501] D. Vogel, Toffel, M., Post, D., "Environmental Federalism in the European Union and the United States," in *A Handbook of Globalization in Environmental Policy: National Governments Interventions in a Global Arena*, ed. F. Wijen, Zoeteman, K., Peter, J. (Cheltenham (UK): Edward Elger, 2005).

[502] Peter Westin, "How Green Was the Flag?: The Maturation of Motorsports' Relationship with Automobility and the Environment," in *Society for the History Of Technology* (Copenhagen, Denmark2012). Page 11

[503] Author's personal experience.

available primarily in the car making countries as *bleifrei* (West Germany), *blyfri* (Sweden), and *sans plombe* (France and Wallonian Belgium). Unleaded became the only non-diesel fuel across the EU beginning in the new millennium as leaded gasoline was banned plus octane levels were typically higher in Europe and would not markedly harm older engines.

All the while during this European boom in environmentalism, the FIA had begun to hear the growing strains of voices within all participant levels about the need for M/S to begin acknowledgment that, as a governing and regulatory body, it must take a more serious approach to the environment, the atmosphere and physical space in which people lived. One of the first steps was to enact regulatory change in 1993 that all fuels must be the same hi-octane option available to the general driving public. While innovative people and entities made individual strides toward achieving what the FIA was hearing, there was not yet sufficient clamor to force larger-scale changes within M/S. Those would become evident on the following chapter.

5.4 THE SPORT

This section will begin with important matters for NASCAR followed by activities and innovations in F1/WEC delving into the critical problems faced and how some were solved, concluding with growth of the series' beyond the technology. In their creative application of scientific methods the mechanics and engineers also had to exhibit their business judgment in resolving their immediate critical problem and this was at times successful, yet at other times excessive.[504] This epoch demonstrated not just physical and geographical growth but served as an incubation period for a new breed of crew member needing the pedigree of an engineering degree. This meant having the mindfulness that M/S was growing beyond the last entrepreneurial innovators and their single-minded approach to a team. Formula One had vaulted over that niveau with the passing of Colin Chapman in 1982, but in NASCAR it still existed in the persona of Alan Kulwicki who was the first to field a racecar in that series with degreed engineers including himself.

A highly respected driver, engineer, and owner, he embodied the positive aspects of the "hell of a fellow" determination to succeed in NASCAR despite coming from non-traditional north-midwestern Wisconsin versus a traditional southeastern state. When he arrived at his first NASCAR race in 1986, he had a limited budget, a racecar, a borrowed pick-up truck, and no sponsor. At the end of a hard fought 1992 season he had a national sponsor in the Hooters chain of restaurants and earned the driving championship even though he did not win the last race. Unfortunately, enroute to a 1993 race at Bristol, Tennessee the Hooters plane he was in crashed. After the crash and on the Friday before the Sunday race, the tractor-trailer transporter for his car and team drove around a rainy track with a black wreath on the front grille as both media and other teams gazed on. In a 2008 ESPN interview, former driver Kyle Petty, son of Richard Petty stated it was , "the saddest thing we had ever seen at a racetrack…We just sat and cried."[505] This honor lap was highly unusual and had never before been done and has not been repeated since in this

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[504] This is borrowed and extrapolated from the book, Rosalind Williams, *Retooling: A Historian Confronts Technological Change* (Cambridge: MIT Press, 2002)., See chapter 2 where she recounts her grandfather's perspective as an MIT engineer in conjunction with Edwin Layton's notion of engineers' balance of the social and the professional.
[505] "Outside the Lines: Alan Kulwicki" *ESPN*, 2008-04-01

manner. It was an activity on behalf of a respectful community that faced death and danger in their profession and can be placed along with the Air Force “Missing Pilot” formation or the Army’s “Last Roll Call” following the active-duty death of a colleague. Such was this community affected by his loss that even 25+ years after his death, drivers have continued to invoke his novel victory celebration of the “Polish Victory Lap” a self-monikered attribution to his own heritage, which meant driving around the circuit in the opposite direction of the race and which brought the driver closer to the spectators as the left side of the car was closest to them.

There was another important element to this particular driver/owner as implied above. The direction of active participants was changing away from independent entrepreneurial ventures in NASCAR’s top tier known as Winston Cup (WC) at the time. By the 1990s the sport had seen the advent of teams with at least two cars under one owner in that economies of scale were becoming major calculations. As a reminder, NASCAR was indeed a capitalist enterprise where profit/loss was a determinant of one’s admission or discharge from the system.[506] In that sense, both NASCAR and F1 were fitting examples of the Schumpeterian outcome as offered by Lamoreaux and Sokoloff whereby, “Schumpeter believed that the rise of large firms in the early twentieth century was making the entrepreneur obsolete.”[507] Where they write of large firms, insert “teams” because M/S

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[506] On the other extreme and previously unheard of, the 2017 champion Martin Truex driving for Furniture Row Racing had to find another ride because that championship team owner decided to fiscally shut down the team.

[507] Naomi R. Lamoreaux, Sokoloff, Kenneth, "The Rise and Decline of the Independent Inventor," in *The Challenge of Remaining Innovative: Insights from Twentieth-Century American Business*, ed. Sally H. Clarke, et al. (Stanford: Stanford Business Books, 2009). Page 43

teams had become firms employing hundreds if not thousands of people (McLaren, Ferrari, Ganassi, et al.) with, in some cases, multi-billion dollar balance sheets.

Returning to the matter of noteworthy NASCAR innovations and safety changes there were many regulation updates but the more salient follow. On the superspeedway tracks such the 2.5-mile Daytona and the 2.667-mile Talladega speeds were surpassing 210-mph in the late 1980s which was beyond the safe handling limit of cars from that era. The seminal episode was at Talladega in 1987 when Bobby Allison blew a tire, went airborne, tore down about 100 feet of catch fencing, and nearly hurtled into the stands with fans watching in horror but fortunately there were no fatalities and the driver was unhurt, yet there were several fan injuries. Consequently for these two superspeedways, as of 1988 the engines for WC cars with their 4-barrel carburetors (versus the 2-barrel on most regular road cars) were outfitted with a device known as a restrictor plate – although it would be several more years before the fencing issue was addressed as will be shown below. Its purpose was to further shrink the aperture through which air/fuel mixture flowed into the pistons. This loss of power diminished top speed and acceleration thus cars were more equal which created new tensions due to the consequence of "pack racing" with more than thirty cars side-by-side and nose-to-tail. Fluid dynamics air movement around this literal train was atrocious and drivers had difficulty controlling the buffeting and jostling within inches from one another at 200-mph. It slowed cars down but did not reduce crashes which resulted in the creation of a new event known as "The Big One" which simply meant that on the two superspeedways, massive, multi-car crashes would occur eliciting various driver opinions from vehement opposition to the capitulation that if the stands were full and nobody was hurt, then it was okay.[508]

Subsequently there were two other innovative measures put into place with the use of Lexan and spotters. As restrictor plates were being imposed, NASCAR also began the use polycarbonate Lexan from GE as a replacement for glass windshields. Even laminated glass was inadequate for the higher speeds and more powerful impacts during crashes and the use of Lexan was deemed safer and more efficient.[509] The other became a necessity with capability to engage in a two-way radio conversation in a loud moving NASCAR vehicle. As speeds increased it had become exceedingly difficult for drivers to monitor the location and movement of the cars near them therefore NASCAR added the role of “spotter” standing on the very top of the grandstands with binoculars actively informing and guiding drivers. This process enabled drivers to concentrate on driving while having an experienced person advising whether an action would be useful, or dangerous.

Another implementation of great significance was the mandate for reduced speeds in the pit area as this eventually was put into place across all forms of racing. The common term used in the broadcasting of M/S crews servicing their teams vehicle was a “bee-hive of activity” in that members were at times physically crawling or hurling themselves over another crew member. With approximately 5-8 men for each car and 40+ cars, the camera positioned to capture video of the entire length of pit road also captured numerous injuries and even fatalities over the years due to unregulated pit entry and departure speeds. As of

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508 J.Brian; Wood O'Roark, William, "Safety at the Racetrack: Results of Restrictor Plates in Superspeedway Competition," *Southern Economic Journal* 71, no. 1 (2004). Page 119. Driver Sterling Marlin opposed and driver Bobby Labonte was in acceptance.

509 For an interesting example of transnational invention simultaneity see, von Hippel. Page 196. Bayer in Germany and GE in America in mid-1950s.

1991, NASCAR required the establishment of safe pit road speeds which varied based on the tracks, width of pit lane, normal track speeds, etc. Over the course of the two following years this notion of controlled pit road speed flowed across the Atlantic to the FIA such that **all** racing series had followed this mandate which was instrumental in eliminating deaths and minimizing injuries for crew members when coupled with mandates for crew helmets in future years.

Two other important safety upgrades became necessary to protect drivers during high-speed roll-over crashes. At the phenomenal speeds that were increasing every year at super-speedways despite the restrictor plates, the first problem had been developing as a result of fluid dynamics associated with air flow around and within these cars. Where the normal road car would have windows, WC cars had window netting at the driver’s side to prevent extremities from protruding and emptiness on the passenger side except for high-speed tracks when a clear plastic insert covered that area for aerodynamic reasons. When travelling straight these were not a concern however when a car was forced into an angular position for any reason while still travelling forward at high speed, air became trapped inside the passenger compartment and under the front cowling as well as in the trunk area. The resultant lift, as if the car were a wing on an airplane, took the car into the air and an out-of-control barrel roll down the track or as a missile into the concrete retaining wall and fencing. The latter is what happened to driver Neil Bonnet during a practice session of the 1994 Daytona 500 with fatal consequences. The cause of this crash became a matter of controversy because NASCAR did not attribute a cause while a six-month investigation compiled empirical data that it was a weak bolt holding a suspension piece that failed thrusting the car directly into the concrete wall. Astonishingly, NASCAR was neither confronted about, nor expected to, provide clarity or transparency into the matter.[510] Accordingly, NASCAR mandated that all cars must have tethered roof-flaps that would open and dissipate the energy held inside the compartment. In addition, as of 1994, all racetracks were required to both add stronger fencing and heavy-duty cable systems to encircle the entire facility without interruption. Both implementations have been severely tested every year since and been improved as cars became heavier and faster.

The second issue was the addition of what became known as the “Earnhardt Bar” after Dale Earnhardt, Sr. During the first couple of years of NASCAR’s 1990 decade, several drivers experienced violent rollovers yet emerged safe and sound albeit very nervous and unsettled. Of those a few encountered conditions whereby the center of the roof over the windshield buckled and encroached on the driver’s head space. Since this had occurred to the most popular driver on the NASCAR schedule, and for no other apparent reason, it earned the nickname above and consisted of a reinforcing metal bar which extended from the bottom of the windshield where it met the firewall in the center then continued upward to the top of the windshield where it intersected with the roofline.

Last for NASCAR, there was an important innovation to benefit the enthusiast participant watching at home on the television (as well as the teams in the paddock) which was the implementation of live GPS tracking of cars on the circuit matched with graphics. The design concept for GPS had begun to form in the mind of Colonel Francis Xavier “Duke”

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[510] Steve; Williams Berry, Charean, "A Broken $3 Part, 2 Racers Dead," *Orlando Sentinel*, June 26, 1994 1994.

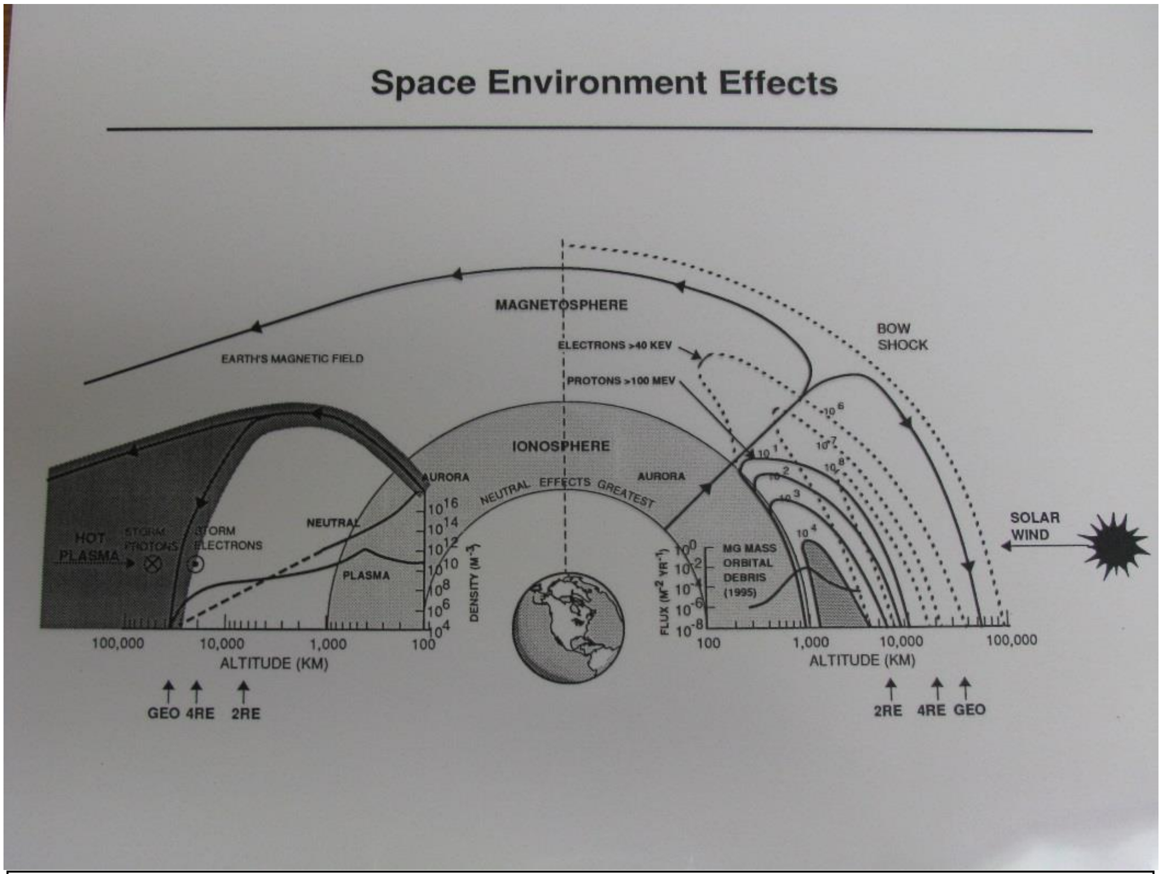

Fig. 5-1: GPS Satellites: Space Environment Effects, Box 3, Folder 2 (GPS Presentations), Accession 2007-097 from Francis X. Kane, Schriever Institute Records, MS 255, University of Texas at San Antonio Libraries Special Collections.

Kane, PhD during the late 1950s and early 1960s for an array of satellites the US Air Force could station in orbit above the earth.[511] Over the next decade a myriad of problems and calculations were tested and re-tested resulting in the system's launch in 1973 for US military purposes but was opened for limited civilian use in 1980 with a purpose to triangulate at least three satellites in order to target and track a moving object. As Denny writes, "it is perhaps the only everyday technology that requires its designers to take cognizance of Einstein's theory of relativity" with its two strands, *special relativity* and

[511] Colonel Dr. Francis Xavier "Duke" (1919-2013) Kane, interview by Peter Westin, 2011, San Antonio, TX.

general relativity.[512] The former are "effects that arise from the speed of the GPS satellite relative to a receiver" while the latter are "effects that arise from the mass of the earth."[513] A very simplified explanation of the former is that moving clocks tick slower than stationary ones and clocks on earth tick slower than one at 20,200 kilometers above earth's surface which is where the NAVSTAR satellite array resides.[514] In calculating time differentials, an error of 38 microseconds per day might not seem consequential to the average person, but that translates to a position error of about 11 kilometers per day thus satellite clocks had to be pre-corrected for time variance prior to launch so that "data sent from GPS is accurate with regard to 'earth' time."[515] This technology was critical to the implementation of the device that is to follow.

Moving forward to *fin du siècle* NASCAR, a privately held company out of New York City named Sportvision and founded in 1998, developed technology-based enhancements for the Internet and sports television successfully linking several technologies in conjunction with a Calgary, Canada based company, NovAtel, that supplied GPS technologies. The purpose was to be able to, "generate graphics, calculate speeds, and compute other performance-related parameters of interest to the racing fan."[516] In a previous chapter timing was the manual function of someone in a team, most often a woman connected to one of the men who drove or owned the team. That function subsequently gave way to

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512 Mark Denny, *The Science of Navigation: From Dead Reckoning to Gps* (Baltimore: The Johns Hopkins University Press, 2012). Page 78
513 Ibid
514 Ibid, Page 79. NAVSTAR stands for "Navigation Satellite Timing and Ranging", Page 76
515 Ibid, Page 79. Quote about "earth time" from PBS interview of Neil Degrasse-Tyson by Charlie Rose on 25 May 2015
516 T. Ford, Milnes, K., "Real-Time Gps Fx on-Screen Positioning of Racecars," *GPS World*2001. Page 12

Fig. 5-2: Timing lights. Personal photo at the ISC Archives in Daytona.

timing lights and then, in the 1980s, the tracks had inductive sensors imbedded under the start/finish line to register car-mounted transponders with unique identification. As can be surmised for the GPS-based effort, several obstacles had to be overcome in order to successfully display graphics such as relative distance between selected cars, overlay of various racing lines, dashboard gauge readings, etc. The system was quite revolutionary at the time and consisted of four subsystems: the GPS, telemetry, time synchronization, and video overlay. In assembling this structure many prerequisites were necessary: multiple cameras were "instrumented" for pan, tilt, zoom, and focus at thirty measurements per second, data packets had to rely on velocity vectors between GPS positions to calculate speed and heading, cars needed transceivers mounted on heavy-duty rubber grommets to absorb 500 miles of multiple G-forces plus vibration, and the antennae had to be center mounted under a flush-mounted dome in the roof.[517] Converting the audio, video, graphics, and calculations required high speed computers but it is unclear in the literature if those were indeed super-computers which had been in service since the 1970s.[518] The final arrangement was successfully tested at the Fontana, California track and implemented at

[517] Ibid, Pages 13 and 15

[518] Donald MacKenzie, *Knowing Machines: Essays on Technical Change* (Cambridge: The MIT Press, 1996, 1998). Page 101

the February 2001 Daytona 500. This had a huge impact on all three types of participants. Active members now had their car's telemetry data transferred from private internal status over to a shared data space, administrative members had to install and maintain additional equipment in the technical landscape of track system plus eventually regulate access to and how the data/video was used, and the enthusiasts were provided another, more informative window into what it was like to be in the car or to have visual representation of a favorite driver gaining on, or pulling away from, a competitor thus their NASCAR experience was enhanced.[519]

In F1, the top teams were receiving ever greater sums of money from both tobacco sponsorship and BE's shrewd negotiation skills with individual circuits which, except for the United States, were partly subsidized by their national coffers to help stimulate travel and tourism in the host country. This led to what shall be referred to here as the "technification" of F1 as manifested in materials and electronics. The active participants in the garages and shops at home base in England were not research scientists but were involved in the application of scientific principles by physically changing and shaping matter.[520] As an example, like a runner's shoe, the ideal goal was to have the lightest yet strongest vehicle within the regulations. Through the 1950s aluminum chassis and frame was the primary choice. In the 1960s fiberglass inner-skin body was previewed by John Cooper but never raced. It was not until 1980 that the McLaren team first introduced the carbon fiber composite chassis.[521] The properties of composite carbon fiber (CF) are quite

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[519] On different forms of representations used by engineers see, W. Bernard Carlson, "Toward a Philosophy of Engineering: The Fundamental Role of Representation" (paper presented at the Proceedings of the American Society for Engineering Education, 2003).
[520] Jenkins. Page 963
[521] ibid. Page 958

surprising to the uninformed in that the end product was (and is) much stronger than steel or titanium in its application yet it was also much more brittle. This was confounding to many, particularly when footage was shown of cars that were in minor on-track skirmishes shedding many shards of material – each of which was enough to slice open the tires on another driver's car.

In order to form this material into a desired shape, it required the use of an autoclave. Originally invented in 1884 by Charles Chamberland using heat and pressure to sterilize equipment and supplies, the versions used in F1 and WEC (and later NASCAR) were larger machines. Those were utilized specifically to bake CF around a specific form or mold that was to be assembled into an F1 racecar and "was soon copied in form or another by every other team."[522] However the initial venture was met with derision and resistance in the MSV until John Barnard with McLaren discovered a company in Salt Lake City, Utah that would take the risk and attempt to make the components.[523] The risk was successful as further efforts in using CF were launched. In the early 1990s, shaping and forming sheets of CF into solid components for McLaren's suspension system was pioneering which then led to all teams copying this technique. The continuous advance of application of CF culminated in the fact that, as of 2010, "Carbon fibre composites now make up almost 85% of the volume of a contemporary Formula 1 car whilst accounting for less than 30% of its mass."[524]

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522 Jenkins. Page 609. See also, Jenkins. Page 897
523 Savage. Page 100
524 Ibid. Page 101

By accepting or declining to apply these scientific and technological advances, a team made a business decision with the realization that a capitalist organization could not survive if it did not meet or exceed the challenges of a competitor's innovations. McLaren clearly made an impact with new things – new technologies for instance – on the existing structure of an industry that caused other teams to disappear from the F1 landscape. This was another element of the Schumpeterian economic model known as Creative Destruction paraphrased in M/S terminology by Peter Wright as the title to his book's chapter two, "Evolve or Die."[525] On this topic, von Hippel informs, "Schumpeter argues that those who succeed at innovating are rewarded by having a monopoly control over what they have created."[526] Furthermore, "Destruction, however painful, is the necessary price of creative progress toward a better material life. But the correct sequence is vital: creative innovation first, then the destruction of obstacles that lie in the way."[527] It was not merely teams referred to as "back-markers" that did not survive like underfunded Simtek which filled out the racing field as launching mechanisms for newer drivers, but also names like B.A.R. (British American Racing) and the venerable Lotus which dominated in the late 70s but disintegrated in the 80s after Colin Chapman's massive heart-attack in 1982.[528] But it was not materials alone that thoroughly altered F1 and WEC, it was the advent of electronics manifest in several ways.

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[525] Wright, *Formula 1 Technology*. Chapter 2. On Creative Destruction see, Joseph Schumpeter, *Capitalism, Socialism, and Democracy* (New York: HarperPerennial, 2008). Pages 83-88

[526] von Hippel. Page 43

[527] Thomas K. McCraw, *Prophet of Innovation: Joseph Schumpeter and Creative Destruction* (Cambridge: The Belknap Press of Harvard University Press, 2007). Page 501

[528] Henry, *The Grand Prix Companion*. There were 108 teams that entered into F1 competition that did not survive for technological of fiscal reasons.

The first to be deliberated here was from a safety perspective. As will be illuminated in the following chapter with respect to NASCAR, crashes on oval courses were much different in nature and character than those on road courses, therefore this section will concentrate on road circuits. Prior to the mid-1990s there was no method to capture empirical data and study details of racing crashes for establishing both cause and effect on vehicle and driver. In both open-wheel and endurance racing in this era acceleration, braking, and cornering placed upwards of 4G's on just the neck and shoulder of drivers.[529] This equated to a minimum of 15-20 events per lap whereby, " a head and helmet mass of approximately 6.5 kg, which would produce a load at 4G of 26 kg."[530] Thus, the physical effort of navigating twisting and undulating terrain coupled with vibrations, thermal loads, and high emotion typically pushed heart rates near 200/bpm.[531] Whereas this would require a civilian doctor or nurse to call for an ambulance transport to the nearest hospital, driver's pulse rates returned to normal relatively quickly.

The major turning point for this issue in M/S was the first weekend in May of 1994 at the now infamous Imola circuit just outside Bologna, Italy. After an unprecedented record of ten years without a fatality in F1, this track suddenly became tarnished with a black mark on the sport. During practice prior to the qualifying sessions, Brazilian driver Rubens Barichello had a shunt that almost killed him had it not been for the on-track medical work

529 For WEC this was the approximate actual seat-time before driver exchange.

530 E. S. Watkins, "The Physiology and Pathology of Formula One Grand Prix Motor Racing," *Clin Neurosurg* 53 (2006). Page 145. As an analogy this was the equivalent of a very large bag of dog food or case of 30 plastic water bottles pressing on the driver's head each of the 15-20 events per lap multiplied by 60-75 laps depending upon the circuit.

531 Ibid. However it must be noted that in one test sample, Frenchman Didier Pironi actually had a decreased heart rate on the Mulsanne Straight at LeMans which was the fastest racing segment of any circuit of the time.

of Dr. Sid.[532] From a more sinister view, the Austrian driver Roland Ratzenberger was killed instantly in a crash during Saturday's qualifying and it deeply impacted the 3-time world champion Ayrton Senna to the point where even Dr. Sid point blank said to Ayrton that he should sit out that race because he was emotionally scarred. Senna's final words to Dr. Sid were "I cannot quit. I have to go on."[533] When the race was started that Sunday there was an initial conflagration not far from the starting line and after cleanup when the race re-started on the second lap it was not long before the red flags appeared to halt the race due to a major event. This time it involved Senna and, after arriving on-scene, as Dr. Sid with help from others lifted him out of the cockpit, Watkins writes that, "though I am totally agnostic, I felt his soul departed at that moment."[534] The exact cause has never been proven with evidence but investigation has yielded numerous avenues of speculation of material failure of a component suddenly causing his car to veer off-course into a concrete wall at 230-240/kmh and an untethered wheel/suspension combination struck his head along with the possibility that a tie-rod from the wheel assembly punctured his new, lighter helmet. What was even more troubling, and which doomed this course from F1, was during the first lap *caramboulage* wheels had vaulted the low fencing into the crowd injuring nine spectators plus in the pit lane a car lost its wheel after a pit stop which injured several mechanics. The combination of these events cast a terrible pall on this facility

To better understand and solve the dilemma of better protection for drivers necessitated data acquisition which elicited the requirement for Accident Data Recorders (ADR) or

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532 Barichello would go on to race many more years and earn 11 victories in F1 before shifting to other racing series

533 Watkins, *Life at the Limit: Triumph and Tragedy in Formula One*. Page 8

534 ibid. Page 10

Event Data Recorders (EDR) – the difference is a semantical one but is important to remember for indexing and keyword search. The initial variants were literally small black boxes, with the same technology as in the orange-colored ones in aircraft, affixed to a central area of the vehicle that would capture G-force measurements, in-race telemetry, and crash impact forces if there was a crash. Within three years of the Imola tragedies, and after significant testing for durability and accuracy, the administrative participants for F1, WEC, and American Indy-cars had mandated their use in all cars for post-race analysis and data dissection.[535] By way of contextualizing, Dr. Sid paints a stark picture for other physical sports by comparing fatalities and head injuries across rugby and "cross-country eventing", and astonishing figures for automobility.[536] As for the relationship between the process of engaging in the activity that was automotive racing and the active participant, that too experienced "technification". By the early 1990s there were so many driver-assist technologies that the vehicles were pejoratively referred to as "Gizmo cars".[537]

A time of movement away from core technologies, techniques, and processes, it was a time of technical experimentation in the vein of the 1960s wing car forays but with upgrades and more advanced opportunities. Establishing the car as an integrated system for the first time during the years on either side of 1990, these racecars were required by FIA to carry on-board television cameras (typically just behind the driver's helmet on the air intake duct) and, over time with FIA approval, they were equipped with electro-hydraulic gear

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[535] Peter Wright, "The Analysis of Accident Data Recorder (Adr) Data in Formula 1" (paper presented at the 2000 SAE Motorsports Engineering Conference & Exposition (P-361), Dearborn, Michigan, 2000). See also, C. S. Weaver et al., "An Analysis of Maximum Vehicle G Forces and Brain Injury in Motorsports Crashes," *Medical Science and Sports Exercise* 38, no. 2 (2006). And also, O. Minoyama and H. Tsuchida, "Injuries in Professional Motor Car Racing Drivers at a Racing Circuit between 1996 and 2000," *British Journal of Sports Medicine* 38, no. 5 (2004).

[536] E. S. Watkins, *Beyond the Limit* (London: Pan Macmillan, 2002). Page 204

[537] Jenkins. PP 898-901

shifters for a semi-automatic transmission, traction-control for acceleration and grip, active suspension to maintain consistent ride height from track surface, plus a variety of other enhancements for whomever was piloting the machine. In the overwhelming opinion of the enthusiast participants, the television camera was the singular positive component. The otherwise general derision came from enthusiasts and drivers alike as they postulated that anyone could be put into the driver's seat and be competitive – it did not require a highly skilled, physically fit, and competitive driver to be in F1. Facing extreme discontent from across the participant spectrum, especially journalists with their acerbic voices and wide reach, the FIA and leading teams met in July 1993 with the end result that all driver aids were to be banned effective the 1994 season. But how did smart, sophisticated teams, venture into realms that all but removed the driver from the winning equation? I submit they were continuously building on what they knew in applying scientific knowledge in accordance with Pickering's precept that, "we have no idea what precise collection of parts will constitute a working machine, nor do we have any idea of what its precise powers will be…We just have to find out"[538] They were viewing new technologies as means toward creating as fool-proof car a race-car as possible marginalizing the role of the driver's skill sets.

One particular novel technology of this larger grouping is worthy of further examination and that was the active suspension system. Normal suspension, or "passive" meant that for normal street cars it was based on shock absorbers and springs to absorb changes in surface height but for M/S it meant a compilation of springs, dampers, and other components. It required each team to transport to every venue a multitude of springs across a broad range

[538] Pickering. Page 24

of stiffness criteria, many roll bars of various ratings, a number of bump-stop rubbers (these were added into spring spirals to selectively add stiffness at each wheel), and a large selection of dampers with different specifications.[539] The reason for this was that racecars had to have suspension settings adjusted for a wide range of conditions to suit the driver at each venue for maximum speed. The setting that might have been successful the previous year might not work the following year due to new car specifications, new track surface, new time specifications, different climate, ad inf. Therefore it was incumbent upon the team to have all options available to adjust a car's settings during practice sessions in order to qualify well for a good starting position when the race began. To be clear, the purpose of a suspension system on a racecar had nothing to do with comfort or having a smooth ride. Its sole purpose was to limit the amount of "roll" or leaning into turns for all series, and to limit the amount of "pitch" when the driver applies severe braking pressure thus dipping the nose of the car, and maintain a consistent ride height of the entire vehicle above the track surface throughout the entire lap for peak aerodynamic performance. The first car to use active suspension was the 1992 Williams FW14B driven by Englishman Nigel Mansell who won the first five GP's that year, plus the driver's championship with five races yet to have been run at the end of the season.[540] In a word, absolute dominance. What was different about active suspension?

First and foremost, the process relied on multiple sensors for both wheel and ride height calculations linked to an on board computer which controlled hydraulic pumps that automatically adjusted to the pre-programmed data sets about the particular circuit while

[539] Matchett. Page 110
[540] Mark Hughes, ed. *The Unofficial Encyclopedia of Formula One* (London: Anness Publishing, 2003). Page 76

instantly calculating velocity and ride-height. What this method supplanted in extra hardware it brought an array of hoses, pipes, and connectors throughout the vehicle.[541] Matchett elaborates further on this complex innovation that, "When reliable and functioning correctly, active suspension is brilliant…when it's not reliable and the systems are functioning incorrectly, it is, quite simply, bloody terrible."[542] For maintenance, when an active component was removed from the system in the garage, the hydraulics had to be bled, or purged, of air. This required the creation of a new piece of equipment call a flushing-rig so that cars were rolled onto the machine and properly connected to a variety of outlets and then a pre-determined program would begin an orchestrated lateral and vertical dance to complete the process. A critical aspect for them keep in mind was that the system had an operating pressure of 2500 PSI (pounds per square inch) which would have permanently disabled or killed a crew member – fortunately there was no record of such tragic event.[543]

We know from previous chapters that M/S innovation sometimes followed an uncertain path that Vincenti refers to as, "seemingly idiosyncratic" and happenstance moments of discovery or inspiration that resulted in new innovations.[544] Also, Polanyi informs that, "Accident usually plays a part in discovery and its part may be predominant."[545] We have also encountered how users were sometimes the sources of innovation as highlighted by Hoogma and Schot in that, " user innovativeness does not only follow from *de facto* use and user characteristics, but also from the quality of the interactions between producers,

[541] Henry, *Autocourse: 50 Years of World Championship Grand Prix Motor Racing.* Page 268
[542] Matchett. Page 111
[543] Ibid. Page 136
[544] Vincenti. Page 180, footnote 24 (307) why 78 degrees for rivets?
[545] Polanyi. Page 120

users, and third parties involved”[546] Furthermore, through the process of hands-on knowing and doing, active participant crew members developed individual “intuitions” which were formulated into “interactionable expertise”[547] This combination of knowledge, intuition, and expertise, merged intellectual components onto a new technological landscape with new concepts on how to produce a faster car sometimes to the detriment of driver consideration which implied the car was more important than the team. This completely violated the traditional “feedback loop” long relied upon in M/S and aircraft design where pilot feedback became an essential element.[548]

However, it was not only faster cars that was the inducement, for some teams it was greater efficiency in fuel mileage thus fewer stops for servicing which meant less time off the track. While this narrative has examined outrageous efforts at using technology, there is one exemplar which goes beyond normal nearing “excess-ability” and one that was practical. “Excess-ability” was found in Chrysler’s attempt to deploy a 500+ horsepower

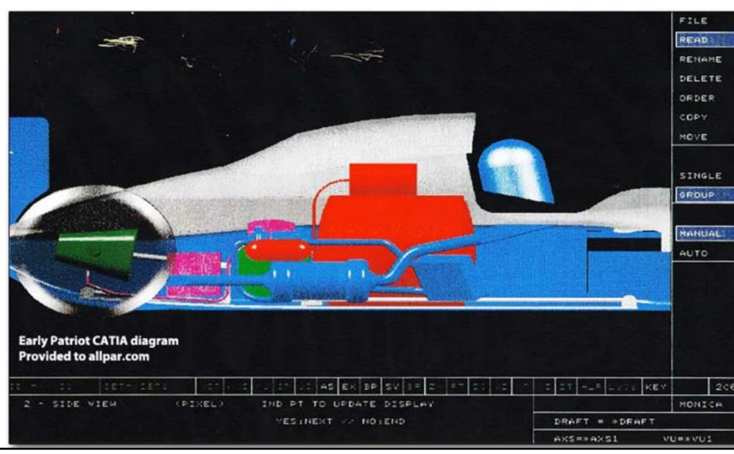

Fig. 5-3 – Computer Aided Three-dimensional Interactive Application (CATIA model) of the Chrysler Patriot. Courtesy: https://www.allpar.com/model/patriot.html

546 R. Hoogma, Schot, J., "How Innovative Are Users? A Critique of Learning-by-Doing and Using," in *Technology and the Market*, ed. Rod Coombs (Northampton: Edward Elgar Publishing, Inc., 2001). Page 230

547 Collins. On intuition see page 149. On interactionable expertise see pp. 137-138

548 Vincenti. Page 76

racecar named the Patriot which was one of, if not **the** most, ambitious attempts at merging numerous “bleeding-edge” technologies and concepts into a single vehicle. With the intent of competing on the 1994 *24 Heures du Mans* at the Circuit de le Sarthe in Le Mans, France, Chrysler had been exploring a return to M/S thus an executive committee approved the expenditure for production with funding and staffing for approximately seventy people. Hired away from the British M/S industry in 1992, Ian Sharp began devising the concept using CATIA software (acronym for Computer-Aided Three-dimensional Interactive Application) which was a multi-platform design program developed by the French aerospace firm Dassault Systèmes. The result was astounding.

Central to the concept car was the use of a regenerative braking system (henceforth as RB) which, in its simplest explanation captured the kinetic energy generated under braking in urban driving like the Toyota Prius. Typically that energy was lost through heat dissipation but could be harnessed for acceleration if captured and stored by either mechanical

Fig. 5-4: Overview of drivetrain elements for Chrysler Patriot. In sequence from top to bottom are: Electric Motor, Flywheel, Vehicle Management Controller, Alternators, and Gas-Powered Turbine. Courtesy: “Emerging Technologies for the Supercar”. *Popular Science*, June 1994

(flywheel) or electric (batteries) means. The Patriot had an audacious assembly which Sharp indicated was a “total energy concept”[549] The basis for this RB application was a carbon fiber flywheel spinning at about 60,000 RPM in a perfect, magnetically balanced vacuum.[550] The technique of maintaining that perfect balance while in a moving racecar at almost 200 MPH and generating 3-4 lateral and longitudinal G’s was reliant upon a “gimbal” system whereby a Hallbach array of magnets capitalized on their opposite polarity to maintain a perfect balance.[551] Other complex components included a twin-turbine generator, electric traction motor drive, LNG (liquid-natural-gas) for cryogenic crash containment if the flywheel experienced catastrophic burst failure, and more all managed by a vehicle management controller.[552] Much of the knowledge and technology on this car came from projects underway by defense contractors “funded by NASA, NSF, and the US Navy.”[553]

As adventurous and enthusiastic as they had been at the outset, ego’s, engineers without racing knowledge, technical incompatibilities, changing personnel (including removal of Ian Sharp from the program), and changing suppliers continuously interfered with any progress that might have been attained such that the few times the car was track tested it was clear the Patriot was nowhere near being in race form. Utilizing a common approach to negative circumstances by implementing a “positive spin” the organization released a

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549 Personal email communication with Ian Sharp.

550 Westin, "A Fly in the Patriot’s Wheel: The Intersection of Applied Research, Regenerative Braking, Motorsports, and Industry." Page 29

551 Some applications refer to a similar technique as “brushless”.

552 "The Chrysler Patriot: Turbine-Powered Hybrid Racing Car - the Future of Formula 1 Racing," allpar.com, http://www.allpar.com/model/patriot.html.

553 William B. Scott, "Shift to Commercial R&D Sparks New Relationships," *Aviation Week & Space Technology* 138, no. 11 (1993). See also, Jon Lowell, "Chrysler Patriot Missile," *Ward's Auto World*1994., Steven Ashley, "Electric Traction Motor Drives Race Car," *Mechanical Engineering* 116, no. 2 (1994).

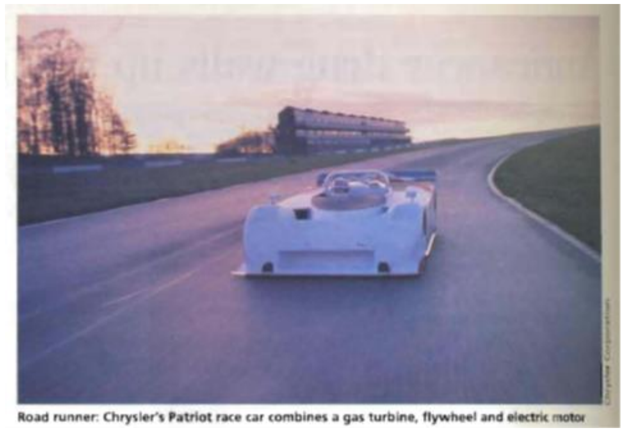

Fig. 5-5: Patriot being towed. Notice pale straight line from center to bottom left corner. If on the track surface, it would have been curved. Courtesy: New Scientist Magazine, 26 March 1994

photo of the Patriot supposedly circumnavigating a racetrack. The problem was that it was not under any independent power and was being towed by a pick-up truck yet an effort to obfuscate the tow-line succeeded somehow even though it is evident that a fuzzy, lightly colored, straight line extends from the front of the car while the asphalt lines of the track indicate a slight curvature in this photo.[554] Highly touted at the outset for its radical technology and the implication that it might soon find its way into passenger cars, it was not a successful venture. Nonetheless, Chrysler still claimed victory in that "it ended up with some 60 patents on the car anyway."[555] Still others thought on, a broader level, how this exercise demonstrated what might be possible in a like manner to where Mokyr describes science after 1850 as it, "was as much to show what could *not* work as to show what *could*."[556] "Like many of history's commercial and technical failures, it's passing was demure and covered by significantly fewer media outlets and trade journals than bid it's

[554] Jonathan Beard, "Green Hybrid Takes to the Track at Le Mans," *New Scientist*, 26 March 1994.
[555] Dan McCosh, "High-Tech Patriot Dies," *Popular Science*, September 1996 1996.
[556] Mokyr. Page 170. Italics in original.

welcome."[557] What was clearly evident in this experience was that there were two diverse scientific communities, each having their own language. The National Laboratories and Defense Department terminologies and applications versus the narrow scientific community of engineers involved not with basic research but with applying the tenets of scientific methods in the specialized fields of M/S.[558] For the corporations sponsoring the research there was a non-ambivalent requirement of, "Come back when you have a practical solution."[559] Thus, in balancing the advances of technology against the fiscal applicability of innovation that were constantly in tension with one another, the words of Roz Williams seem quite salient, "Scientific judgement had to be weighed along with business judgement, and their identity as engineers was a constant effort to balance the two systems."[560]

Fig. 5-6: Panoz Q9, also known as "Sparky" for its battery-based RB system. Courtesy motorsport.com

557 Westin, "A Fly in the Patriot's Wheel: The Intersection of Applied Research, Regenerative Braking, Motorsports, and Industry." Page 31 See also, Mike Aberlich, "Chrysler's Patriot Will Use Racing as Testbed," *PRNewswire* 1994., Joseph Lee, "Boost U.S. Labs' Role in Technology Transfer," *Aviation Week & Space Technology* 137, no. 23 (1992). And David Hughes, "Technology Transfer Now a Top Priority," ibid.139, no. 19 (1993).

558 Contributions came from Argonne, Oak Ridge, Lawrence Livermore, DARPA, and many other federal entities.

559 Tim Keenan, "Technology Transfer: Aerospace Comes Down to Earth," *Ward's Auto World*, March 1995 1995.

560 Williams. Page 38

A few years later another effort at RB in the WEC series was attempted during the mid-late 1990s with the development of the Panoz Q9 nicknamed Sparky. The Panoz Motorsport entity in Hoschton, GA (fifty miles northeast of Atlanta) was one of the companies formed by Dr. Don Panoz who made a fortune in pharmaceutical manufacturing in Ireland. He also started the American LeMans Series (ALMS) based on the 24-hour events at Daytona and LeMans but races were at most 6 hours in length to attract and appease American enthusiast racing appetite. With respect to the powertrain, instead of a flywheel, the system incorporated a "Zytek permanent magnet brushless DC motor independently coupled to the transaxle with a mid-engine Roush-tuned Ford V8" in addition to batteries that filled out the right side of compartment next to the driver. [561] Although it did not qualify for LeMans that year, it did compete in 1999 but the actual physical weight of the batteries, odd center of gravity, and lateral/longitudinal load prevented further development. A decade later, when queried about Sparky, Dr. Panoz' s response was, "The world in 1998 just wasn't paying much attention to [hybrid race-car] so we couldn't get a lot of traction."[562] It is additionally illustrative of a seemingly lost opportunity that Peter Wright penned in 2001 how, "The opportunity to make a real contribution to the development of lightweight efficient hardware and control strategies for hybrid road cars has been lost."[563]

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561 Marshall Houston, "Revolutionary Hybrid for the Le Mans Series," http://www.electrifyingtimes.com/bird.html. Roush and Zytek are still very active in their respective industries.

562 Staff, "Panoz Comments on First Competitive Hybrid," Motorsports.com, http://www.motorsport.com/alms/news/panoz-comments-on-first-competitive-hybrid.

563 Wright, *Formula 1 Technology*. Page 211

What is interesting to note is that neither of these cars were revolutionary. Evolutionary in the context of Basalla's case studies in ***continuity***, yes, but not revolutionary.[564] Continuity is the continuous nature of change whereby a novel innovation builds upon a previous iteration of the artifact. The concept of RB was already in use for electric railways/trolleys in large cities around the turn from 19th to the 20th centuries. Further, Belgian inventor Henri Pieper submitted a US Patent for "Mixed Drive Automobiles" in 1905 and W.P. Kirkwood wrote an article for the September 1929 journal "The Automobile Engineer" which contained a graphic depiction of wasted energy from braking which could be captured through RB. [565] Then, in 1950, French engineer-inventor F.E. Myard wrote an article in the March edition of *Le Genie Civile* about rubber rings for propelling RB systems.[566] This was followed shortly thereafter by A.F. Hayek with his 1964 U.S. patent # 3,126,070 using silicon rubber and in 1967 Robert Aronson filed his patent # 3,530,356, "Regenerative System for Electric Vehicle".[567] Therefore, Basalla's notion of continuity is apparent and applicable in understanding the path to novelty of RB in M/S. Also, to continue a thread exposed above, by the end of the 20th century the existence of inventive and innovative entrepreneurs in M/S were no more thus validating Schumpeter's statement concerning firms (aka teams) having pushed them out. But while the concept of RB was not yet among the capabilities of technology in M/S, it would re-appear in the following decade

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[564] Basalla. Pages 31-57. Bold italics are this author's for emphasis.
[565] The Pieper patent is US Patent # 913,846. "…comprises an internal combustion or similar engine, a dynamo motor direct connected therewith, and a storage battery or accumulator in circuit with the dynamo motor…" For Kirkwood's depiction please see, W.P. Kirkwood, "Automobile Brakes," *The Automobile Engineer* 19, no. 258 (1929). Page 351
[566] F.E. Myard, "Frein a Inertie a Récupération," *Le Génie Civil* 127, no. 5 (1950).
[567] Patent was awarded 22 September 1970

While potentially seen as de-skilling or circumventing driver input in person or via radio (as had become a standard "technology in use" by this time) the data points of track conditions and vehicular behavior/reaction were important for the team to manage the operation of the racecar. In order to process this stream of information required the use of robust computers, as revealed above for television graphics, to both capture data and convert this data into actionable modelling in assisting with future car design or set-up. The literature on IT systems in M/S beyond the closely held private documents has yet to be uncovered for this period but it is known that McLaren installed a Sun Microsystems supercomputer in 2001 – more to follow in the next chapter. What is also known is that devices like chart recorders and analog tape recorders were used in M/S from the late 1960s into the 1980s.[568]

5.5 SYSTEM GROWTH

Having discussed the technical growth and the associated critical problems, the examination turns toward the physical growth both of tracks and top tiers of M/S in general. Beginning again with NASCAR, the existing ovals were required to implement the safety enhancements discussed above or be removed from the schedule. There was, however, one additional enhancement that would have a major impact on the future of NASCAR racing. Until the mid-90s only two tracks had lighting to enable night races, the half mile colosseum known as Bristol (1978) in Tennessee and the 1.5-mile semi-oval in Charlotte, NC (1992).[569] Therefore NASCAR only ran on Sunday afternoons. However, most of the

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568 Wright, *Formula 1 Technology*. Page 169. On development of computers for special purposes see, MacKenzie. Chapter 4

569 Bristol was referred to as Coliseum because it was one of the shortest ovals yet offered a steeply banked race space, intense action, and seating capacity of approximately 150,000 people.

drivers of this era actually developed their talents in the lower rungs of the ladder at Saturday night races under the lights. Several, but not all, other facilities eventually were outfitted with powerful lighting systems but it was not until October 1998 that a superspeedway added night lighting at Daytona yet the massive Talladega remained without night lighting. Adding lights was monumental because it altered fields of vision, visual acuity, and depth perception on the part of drivers, complicated pit crew servicing as they needed to develop new devices to provide hands-free lighting equipment, and required changes to each system's infrastructure, energy consumption, and so forth.[570]

When Bill France, Jr succeeded his father in the early 70s, he saw as his charter to grow the NASCAR brand geographically and to fulfill his father's vision of "sea to shining sea".[571] The lone state on the West Coast had been California at two separate locales in the name of Ontario Speedway and the Riverside road course, neither of which physically exist anymore. [572] In order to make this expansion beyond the traditional Southeast boundary a reality, it would take many years of planning and negotiations thus it was not until the period 1988-1999 that eight new ovals were added to the Winston Cup (WC) schedule.[573] Consequently, several older and smaller or isolated sites were no longer welcome in the top tier of NASCAR. Earlier, we examined the significance of the 1992 Hooters 500 in Atlanta, GA when Alan Kulwicki won the championship (but not the race). It was also a changing of the guard albeit unknown at the time. That race saw the final competitive laps

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570 A. G. Schneiders et al., "Visual Acuity in Young Elite Motorsport Athletes: A Preliminary Report," *Phys Ther Sport* 11, no. 2 (2010).

571 Branham. Page 90

572 Martin Rudow, *Lost Road Courses* (Forest Lake, MN: CarTech, Inc., 2016). Chapter 11 – Ontario, Chapter 12 - Riverside

573 Oliver. The venues were: Phoenix, AZ (1988), Sonoma, CA (1989), New Hampshire (1993), Indianapolis (for NASCAR-1994), Fontana, CA (1997), Ft. Worth, TX (1997), Las Vegas, NV (1998), and Homestead, FL (1999).

for 7-time champion Richard Petty and the first WC level race for a young man from California named Jeff Gordon who would go on to win 93 races and four championships followed by his teammate, Jimmie Johnson, also from California, who go on to win seven championships as well.[574] Bill France, Jr.'s implementation of "Big Bill's" vision congealed quite nicely from their perspective.

In 1986, WGI returned to the NASCAR Winston Cup (WC) schedule but it took great effort and coordination. After falling into bankruptcy following the removal of F1 very early in the decade, WGI was a shell of its former self. Then, in 1983 even though Bill France, Jr. was interested in acquiring the course for his company the International Speedway Corporation (ISC), he was side-tracked by the availability of an even more iconic symbol for NASCAR, that series first speedway in Darlington, SC. Meanwhile several executives and enthusiasts at Corning Glass Works, a local manufacturing conglomerate, became interested in bringing back major racing events like NASCAR-WC among others to WGI to help support the local economy based on their knowledge of its impact on Daytona. Jim Riesback was a senior executive at Corning and quite keen on the idea that a group known as the Green Flag Advisory Committee was seeking a new owner. A wholly owned subsidiary known as Corning Enterprises was formed and acquired the property on October 23, 1983 thus providing a new lease on life as a major M/S venue.[575] NASCAR returned there full-bore in 1987 racing uninterrupted to the current day.

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574 There have been many other drivers from western states how have earned victories as well as championships.

575 Book: O'Malley, J.J., Green, Bill, *Watkins Glen, From Griswold to Gordon :Fifty Years of Competition At the Home of American Road Racing,* William Green Motor Racing Library, IMRRC, Watkins Glen, NY

Unlike many of the heritage ovals in the southeast that remained on the racing calendar and were somewhat isolated from population centers (like Bristol, TN and Martinsville, VA), the additional race spaces were closer to larger metropoles in order to draw upon larger demographic pools of enthusiast participants. It worked well from 1993-2002 with respect to the M/S trifecta that was Sunday of the Memorial Day weekend. On that day three of the most iconic M/S competitions took place, the F1 Grand Prix of Monaco, the Indy 500, and the NASCAR Coca-Cola 600. Initially, since there were no lights at Charlotte until 1992, the Indy 500 and the 600-mile NASCAR race were broadcast simultaneously and over the ten years indicated above, "an 87% viewership shift occurred" away from the open-wheel Indy race to the 600.[576] A fortuitous set of circumstances came about as of 1992 in that NSACAR spectators wanted a later start time for the 600 race because of the oppressive southern climate which the broadcast networks seized upon in order for each race to have their quasi-monopolistic coverage as no single network covered more than one race. From the perspective of the enthusiast participant it became an intense day of immersion observing how the active participants contested both man and machine at the limit.

The physical growth of F1 took shape in a very different manner for a variety of different reasons. Of primary consideration was the benefit of BE's shrewd maneuvers to consolidate any and all media coverage of F1 under his control, writ large, negotiate from position of strength with each national media organization by leveraging a global scale. A component of his vision was to expand beyond Europe despite the protestations of the Euro-centric FIA leadership. Of the 17 circuits added during this phase, five were in

[576] Branham. Page 93

America, five in Asia, and the previously discussed Hungaroring near Budapest plus, in what might be seen as an alignment with NASCAR's strategy for expansion, fourteen were near major metropoles. Of major implication was how circuits were added/dropped and terms negotiated for a global entity.

With NASCAR, all top tier ovals were owned by two entities except for three spaces, Dover, DE, Indianapolis, IN, and Pocono, PA. The two major entities were International Speedway Corporation from Daytona, FL and Motor Sport Incorporated in Charlotte, NC. Most WC facilities experienced two races per season with the exception of road courses which were allotted one race apiece, ergo there was a certain familiarity and "comfort" that, as enthusiast participants, if a one missed a race in the spring one could still experience the second. There was a certain routineness and expectation that a particular weekend would take place even if specific dates changed. Did this contribute to a later decrease in attendance at both events at a given site?

With F1, individual circuits were subsidized by national governments versus a capitalist style of ownership with expectations of a profit margin. There was no regular negotiation schedule but were unintentionally staggered by BE as it was: 1) a global spectacle, and 2) dependent upon cooperation of a particular venue to suit the updated needs of FIA safety and, 3) the FOCA. The fluidity of rule changes, financial viability, and infrastructure compatibility were the guideposts for administrative participants to carefully manage in order to maintain a space on the F1 calendar.

During this timeframe the American expansion of F1 into America was, to be kind, a fiasco. Schizophrenic at best, those events were a series of parking lot and street events that tried to fit grand visions into luddite spaces.[577] While there was an appetite for F1 in America, there was no sense of national pride or connection to a driver in the way that was manifest in Europe. Nor was there any corresponding desire or underpinning to support the scale of magnitude to implement a major global event involving open wheel cars with driver names that were unrecognizable to locals who were not really M/S enthusiast participants. The end products clearly displayed the lack of planning, infrastructure, attendance, and federal investment a la Europe and Asia that would limit the life-span of F1 in America to a future generation. Also, the other new race spaces that were distant from major metropoles were short-lived as they had no heritage or history thus no visceral connection with participants.[578]

There was one addition from 1980 during this growth phase which indeed had potential as a great racing venue but met with an immediate termination from the F1 schedule and that was Imola Italy. As discussed above, that terrible 1994 tragedy took the lives of Ratzenberger and Senna plus caused injury to so many others. The very location where Senna was killed could not be modified, cushioned, or transformed in any satisfactory way. Behind the concrete wall and catch fencing was a waterway (*Fiume Santerno*) that did not belong to the property of the *Autodromo Enzo e Dino Ferrari*, plus any work would have essentially closed the facility to all other income-generating activities plus Monza was Italy's premier auto racing race space. It is useful to be aware that all of the non-American

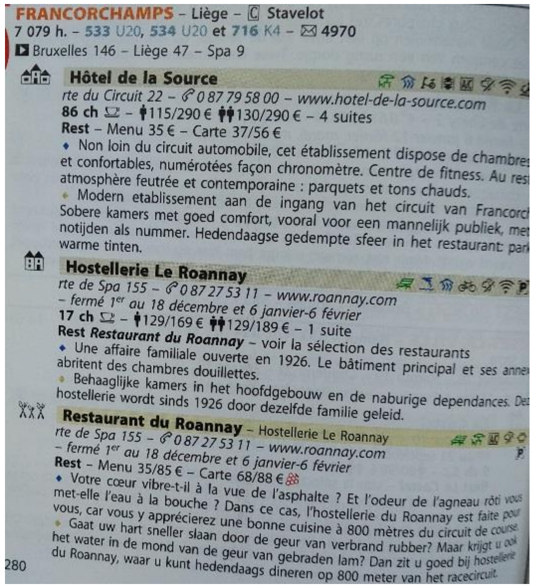
[577] Those venues were: Caesar's Palace in Las Vegas, NV (1981); Detroit, MI (1982); Dallas, TX (1984); Phoenix, AZ (1989); and Indianapolis, IN (2000). Some experienced more than one race event, surprisingly.
[578] Those circuits were: Jerez (Spain), Mangy Cours (France), and Aida (Japan)

locations that lost their place in F1 continued to host other activities and race series, most often European "stock cars" and the highly popular two-wheeled Moto GP.

As a result of the Imola incident, several initiatives were undertaken in this epoch to further upgrade safety at existing facilities and were added as requirements to any new sites in BE's global expansion plan. Dr. Sid and the safety committee named by the FIA as the Advisory Expert Group embarked on detailed studies of brain injuries, such as their prevention and obstacles toward implementing plans, plus they identified 27 "high-risk" corners across F1 and removed 15 of them.[579] Then the FIA required, in chronological order, fire suits for pit crews, converted gravel beds at turns to asphalt run-offs (to prevent flipping cars), and stronger standards for tire barrier inserts. Any attempt to detail medical and safety enhancements would venture too far out of scope here but two in particular clearly address the sincerity by which Dr. Sid and BE approached this critical problem. For the follow and safety cars, arrangements were made in 1997 to have two powerful Mercedes CLK 500 and two high-powered station wagons as well as six other vehicles present at each race. From the medical standpoint, each GP required an English-speaking anesthetist or surgeon from a local hospital for any language issues. For all the clamor about BE's soulless and callous approach to business dealings and lack of interpersonal skills, he was deeply affected by the fatal crashes by drivers on his teams and the very few with whom he had developed a relationship. This weighed heavily upon him thus his secondary goal to maximizing the F1 brand was making the sport safer without over-reaching regulations.

[579] Watkins, *Beyond the Limit*. Pages 167-174

5.6 SPA – FRANCORCHAMPS



FRANCORCHAMPS – Liège – Stavelot
7 079 h. – 533 U20, 534 U20 et 716 K4 – 4970
Bruxelles 146 – Liège 47 – Spa 9

Hôtel de la Source
rte du Circuit 22 – 0 87 79 58 00 – www.hotel-de-la-source.com
86 ch – 115/290 € 130/290 € – 4 suites
Rest – Menu 35 € – Carte 37/56 €
Non loin du circuit automobile, cet établissement dispose de chambres
et confortables, numérotées façon chronomètre. Centre de fitness. Au res
atmosphère feutrée et contemporaine : parquets et tons chauds.
Modern etablissement aan de ingang van het circuit van Francorc
Sobere kamers met goed comfort, vooral voor een mannelijk publiek, me
notijden als nummer. Hedendaagse gedempte sfeer in het restaurant: par
warme tinten.

Hostellerie Le Roannay
rte de Spa 155 – 0 87 27 53 11 – www.roannay.com
– fermé 1er au 18 décembre et 6 janvier-6 février
17 ch – 129/169 € 129/189 € – 1 suite
Rest *Restaurant du Roannay* – voir la sélection des restaurants
Une affaire familiale ouverte en 1926. Le bâtiment principal et ses anne
abritent des chambres douillettes.
Behaaglijke kamers in het hoofdgebouw en de naburige dependances. De
hostellerie wordt sinds 1926 door dezelfde familie geleid.

Restaurant du Roannay – Hostellerie Le Roannay
rte de Spa 155 – 0 87 27 53 11 – www.roannay.com
– fermé 1er au 18 décembre et 6 janvier-6 février
Rest – Menu 35/85 € – Carte 68/88 €
Votre cœur vibre-t-il à la vue de l'asphalte ? Et l'odeur de l'agneau rôti vous
met-elle l'eau à la bouche ? Dans ce cas, l'hostellerie du Roannay est faite pour
vous, car vous y apprécierez une bonne cuisine à 800 mètres du circuit de course
Gaat uw hart sneller slaan door de geur van verbrand rubber? Maar krijgt u ook
het water in de mond van de geur van gebraden lam? Dan zit u goed bij hostellerie
du Roannay, waar u kunt hedendaags dineren op 800 meter van het racecircuit.

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Fig. 5-7: Hotel listing for Francorchamps from 2014 *Belgique* Michelin guide. Notice the first hotel name as it is 100 meters from the track opening at La Source. Notice also the dual French/Flemish text as required by law. Personal photo of personal copy of guide.

The fearsome road course known today as Spa-Francorchamps began as a circuit mapped out through multiple villages and hamlets in the Ardennes region of Belgium in the Liège province of the French-speaking Wallonia. Well-known since Roman times for the health benefit of its mineral springs, Spa "reached its zenith in the 18th century as a destination for European royalty."[580] The municipality of Spa was not directly on the circuit but the northern tip is near the village of Francorchamps and the terrain of this region is quite hilly in the same manner as the N-ring in previous chapter.

It was a confluence of circumstances that led to the creation of favorable conditions for motorized competitions in the region. First was that Spa and its healthy water was already

[580] "Spa," in *The New Encyclopaedia Brittanica*, ed. Phillip Goetz (Chicago: Encyclopaedia Brittanica, Inc., 1988). Page 60, a,b

an international destination. Second was the fact that Liege and the surrounding area was an industrial center for the manufacture of automobiles (35 marques) and motorcycles (41 brands).[581] Third, like a WGI, was the existence of men who wanted to develop M/S in this area. The year 1896 saw the commencing of a variety of racing competitions on local roads with the initial race from Brussels to Spa which led to the area becoming popular for engaging in this activity. In 1902 Baron Pierre Crawhez inaugurated the first "*Circuit des Ardennes*" which lasted for five years.

Following World War I, a meeting took place between two members of Belgian royalty, Chevalier Jules de Their and Baron Joseph de Crawhez (brother to Pierre above), and racer Henri van Ophem, a member of the Royal Automobile Club de Belgique. The result was the creation of a triangular course with the points touching on Francorchamps, Stavelot, and Malmedy following the direction of travel shown on this map.

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[581] R. Bovy, et al., *Spa-Francorchamps: Histoire D'un Circuit De 1896 À Nos Jours* (Bruxelles: Luc Pire Éditions, 2009). Page 6

A few points of interest regarding the map in Fig. 5-8 (below) with the first being the counter-clockwise direction of travel as indicated on the map is opposite from a multitude of historical images in this chronicle and it is unclear when or why circumnavigation changed direction. Situating the reader will start with the apex of the displayed track that is known as La Source (like the hotel in the Michelin guide above). Continuing in opposite direction of the arrows, and mimicking a driver's viewpoint, the sharp left is at the Eau Rouge creek which will be further detailed below. From a non-M/S historical perspective, it is instructive to illuminate the map term *Ancienne douane allemande* just to the right of that same Eau Rouge turn as that was the former boundary between Belgium and Prussia still demarcated today with concrete posts indicating "B" and "P" respectively. Following

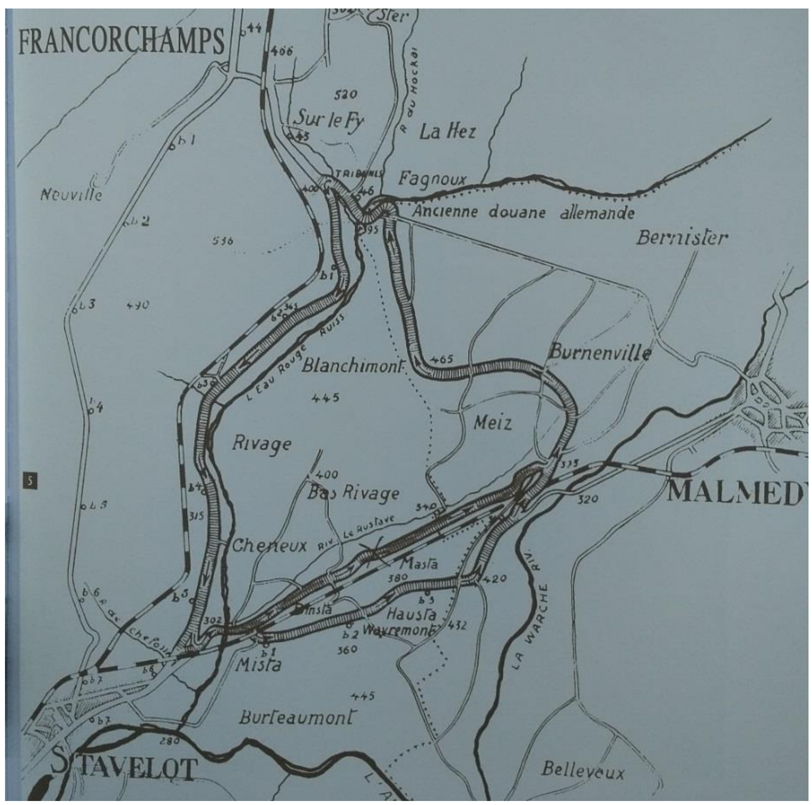

Fig. 5-8: 1920 Map of Spa circuit. From the book *Spa-Francorchamps: Histoire D'un Circuit De 1896 À Nos Jours*. Page 17. Notice the strikethrough in pen of the straight section from Stavelot to Malmedy in favor of the more curvy segment to the south.

the war, a relatively large (for this tiny country) swath of land was taken from the resultant Weimar Republic and yielded to Belgium extending the country's footprint eastward. The first car race was held in August 1922 on many dirt road segments as the course was not completely paved with asphalt until 1928.[582] Subsequently, national, community, and sporting governing bodies recognized the need for a more formalized structure of M/S but that was placed on pause with the interruption of World War II.

It must be elucidated here that Malmedy and the Ardennes (particularly the city of Bastogne) had alternately significant roles and became infamous and famous places, respectively, in the annals of history regarding the Second World War and its outcome. What has been charitably referred to in the literature as Hitler's Last Gasp effort in the winter of 1944 to reach the Belgian port of Antwerp initiated with an intense armored assault through a soft underbelly of the Allied effort that created an immense reverse salient for the Allies and their advance. The critical problem of that time was twofold, cut off the German advance and relieve the surrounded 101st Airborne Division in Bastogne as was accomplished by General Patton's Third Army. But that would not save the Americans massacred at Malmedy.

In December 1948 a new organization was created with a 30-year charter known as *Association Intercommunale* and a mandate to expand tourism and the *sports mécanique* in the *Haute Ardennes* using the *Circuit de Francorchamps.* At the end of those thirty years the *Intercommunale* was re-chartered for another thirty having added many more localities and organizations to the membership and on 25 January 1979 the rebuilt course was

[582] ibid. Page 30

formally re-named as "*Circuit de Spa-Francorchamps*". It bears mentioning that since the notion of M/S and automobility was essentially ingrained into the communities around Liege because of its connection to production of motorized vehicles there was a general approval for racing on public roads of the time and the eventual purpose-built facility in keeping with public sentiment around the WGI and Daytona.

The race space for Spa was essentially unchanged from 1924 to 1978 with its approximately 14 kilometer total distance per lap – except for Eau Rouge and Raidillon in 1939 to be profiled below.[583] Both cars and motorcycles had negotiated the black ribbon as it wound its way through villages and countryside, between farmhouses and barns, telephone poles and barbed wire fencing bounding grazing animals, as well as dense forests.[584] Like the initial road course at WGI, the spectators in most sections had minimal protection, if any at all, to separate the soft human body from a several hundred kilogram metal object travelling at least 100-kmh and in some places almost 250-kmh. Over time

Fig. 5-9: Converting Stavelot from a sharp right turn to a transitional racing curve. Courtesy the book: *Spa-Francorchamps, Une Histoire,* page 62

[583] P. Higham, Jones, B., *World Motor Racing Circuits* (London: The Square Book Company, 1999). Page 169
[584] Rene Bovy, "Rene Bovy," in *Grand Prix: The Killer Years,* ed. John Matthews (Manchester: Bigger Picture Projects, LTD, 2014). Pages 74-88

there were incremental additions for safety such as sand-bags and wood/cinderblock barriers. In 1950 two major changes occurred with the first being the widening of the track to eleven meters and the second a purpose-built curve at Stavelot. Both of these were likely the result of the creation of the FIA and its establishing certain racecourse standards. The former was to enable more separation between cars in overtaking situations and the latter to replace a sharp turn with a more gradual transitional curve.

The majority of safety measures were, for the most part ineffectual as the velocity propelling the racecar mass in the 1960s was exponentially more consequential than had been anticipated by the administrative participants who had no engineering or scientific resource to counsel them. In 1960, the Spa circuit experienced its most tragic weekend in F1 history as driver Mike Taylor (UK) was seriously injured in a practice crash and World Champion Stirling Moss (UK) also crashed heavily in practice breaking both legs and his nose. Worse still, two English drivers, Christ Bristow and Alan Stacey would be killed in the actual race in separate accidents.[585] There was some speculation that neither of these young drivers had the experience of driving on a topographically challenging circuit like Spa versus a background of flatter tracks like those in England.[586] While seemingly callous and insensitive at its surface, the treacherous dynamics of racing at very high speeds across the undulating spaces of Spa and the N-ring require vastly different skills than the high-speed flat Silverstone. Again, the matter of a divergence between skills and abilities moves to the forefront for drivers. What could neither be regulated nor controlled at Spa was the weather thus driver tensions were continuously heightened when traversing this race space

[585] Bruce Jones, ed. *50 Years of the Formula One World Championship* (London: Carlton Books, 2001). Page 69
[586] Bovy. (Grand Prix) Page 78

because not only did conditions change without notice, it could have been raining a downpour at one section yet dry and full sunshine at another. The rain became a serious matter in 1966 for Jackie Stewart that nearly cost him his life.

Rain at Spa had always been a major test of a driver's mettle more than at any other racing space because of the terrain and the team's decisions to pair the proper equipment to meet the challenge of intense competition, massive elevation changes, and weather. When that race started it was clear in retrospect that it should never have begun. Rivulets of water were streaming in various locations either perpendicular to or at oblique angles to the racing line, both of which were dangerous. The tires of that day were not slick but neither were they properly grooved to funnel away water to prevent hydroplaning. Well chronicled across M/S and safety literature, on the very first lap the small contact patch where tire met asphalt for Jackie Stewart's car was lost due to one of those rivulets causing his car to hydroplane and leave the track. In so doing his car, "hit a woodcutter's hut; knocked down a telegraph pole; hit part of a wall; went down into a lower basement area of a farmyard."[587]

Fig. 5-10: Jackie Stewart's car after it had been flipped over from being upside-down. Courtesy the book: *Spa-Francorchamps, Une Histoire*, page 104

[587] Jackie Stewart, "Sir Jackie Stewart," ibid. (Bigger Projects LTD). Page 44

Shortly thereafter F1 World Champion Graham Hill and American Bob Bondurant spun around in the same spot but they saw Stewart's predicament thus they stopped to get out of their cars and help.[588] Stewart was still strapped into his seatbelts while fuel was spewing onto him. Hill encouraged the people around the accident to find a "spanner" (monkey-wrench) to release the steering wheel and remove the unconscious Stewart from the car. Twenty minutes later the ambulance arrives for transport to the "medical center" consisting of a room, a stretcher, a doctor, and a surgeon"[589] While Stewart was laying there in pain from broken bones and pelvis, he became conscious and the first thing that became visible was "cigarette ends on the floor of the medical centre."[590] Worse still was the ambulance ride to the Liege hospital because the police escort outran the ambulance and the driver did not know how to get to the hospital.[591] This brief story would be stunning on its own, but it shaped Stewart's vociferous mantra of fighting for driver safety from that day forward and as a future 3-time World Champion he had earned the platform to make the case for continuously improving safety.

Surprisingly, that was not the catalyst event to stop F1 racing at the Spa circuit, however it would begin to create tension between the administrative and enthusiast participants about the future. The chief administrator of the circuit, Léon Sven, promoted the notion that the cars needed to adapt to the circuit while the, "*PDG du journal Les Sports*", Pierre Stasse, championed the cause for tracks needing to adapt to the cars.[592] This diametric opposition on the future of M/S once again appears at Spa as it had at the N-ring, Monza, and others

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588 Wright, "The Role of Motorsport Safety." Page 1264
589 Bovy. Page 83 Years later, Bovy still had no answer for why it took 20 minutes.
590 Jackie Stewart, "Sir Jackie Stewart," ibid. (Bigger Projects LTD). Page 45
591 Ibid
592 Bovy. (*Histoire*) Page 110. See also, Bovy. (Grand Prix) Page 80

of that era. Race organizers of the time had a callous attitude toward driver safety because those pilots were perceived as expendable, the gladiators of the technological coliseum, and impetus toward safety was rebuffed with asides similar to “Besides, we don’t have the money” or the even more incredulous “It’s too expensive”[593] However, it was the GPDA who had the final say in the matter against the course in that it was simply too fast and too dangerous in the configuration of the day in 1970. That was the final F1 competition until 1983 but many other *sports mécanique* competed at Spa during the interim.

The pride of a nation was now at stake and alternative sites had to be secured. It was impossible to substitute a venerable and widely respected space like Spa and the replacements were, in fact, ignominious at best. Further, any major endeavor at a national level in Belgium required both a Wallonian (French) solution and a Vlaams (Flemish) variant. The French-speaking solution was represented by the anemic Nivelles-Baulers (more commonly referred to as just Nivelles) circuit and the Flemish response was the unfortunate, black-cloud shrouded Zolder. With a bilingual nation like Belgium, it was important and required to alternate competition every other year between venues in both halves of the country.

Nivelles was a truly unremarkable location 20 miles south of Brussels with a length of just 3.7 kilometers, tame curves, and low speeds so it was no great revelation that only two races were held there.[594] So uninspiring was it that the first organizer went bankrupt even

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[593] Bovy (Grand Prix) Pages 82, 83, 85. To be absolutely clear, there is a vast litany of similar contemporary attitudinal comments from multiple countries and race organizers too extensive to be treated here.

[594] This author was a spectator at both Spa in the Eau Rouge section and at Nivelles thus draws from personal observation and sentiment.

before the first race.[595] To further exacerbate the misery, the second organizer fared no better filing bankruptcy in 1975.[596] Nivelles languished for six more years as an "also-ran" venue for various events until it was turned into a business park although the track layout is still visible in aerial footage.

The latter, Zolder, was about 60 kilometers east of Brussels and only marginally more remarkable in but its legacy would be much darker. Originally built in 1963 it was marginally updated to meet FIA status but during the very first F1 race in 1973 the track surface started coming apart within the first hour of the race. The result was damaged or crashed- out cars strewn throughout the four kilometer circuit and a very narrow band for the few remaining cars to drive through.[597] In 1981 a shambolic start resulted from an ill-advised protest and occasioned a mechanic, while trying to push start a driver's car, to being stuck and injured by his teammate's car. Further, another mechanic was killed after stumbling off of the signaling ledge between the pit road and the front stretch after he was clipped by the eventual race winner who, somberly, did not celebrate his win. However, the most notorious event for this locale happened the following year (1982) with the death of the very popular Canadian driver Gilles Villeneuve during practice. He had rapidly come upon a much slower car and, after colliding, Villeneuve vaulted into the air with him being separated from the car, still with seatbelts around him resulting in fatal neck injuries. With Spa having been approved in its new configuration to host F1 again it would be the return so long sought after by all participants.

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[595] Hamilton. Page 152
[596] Bovy. (*Histoire*) page 122
[597] Hamilton. Page 160

Fig. 5-11: Construction at La Source and of the paddock area. Notice the directional signs at the point (center bottom) because in the late 1970s it was still a public road. Courtesy the book: *Spa-Francorchamps, Une Histoire*, page 141

When F1 left Spa in 1970, the race space was just over fourteen kilometers in length. When re-construction was complete in 1979 and when the tour returned in 1983 it was just under seven kilometers yet it still retained many of its challenging features. When drivers had finished that first weekend back at Spa, they were unanimously pleased with the appropriate balance between driving thrill for them as well as safety measures to properly protect them. Former F1 driver Martin Brundle (UK) referred to Spa as, "one of the most exhilarating places on earth on which to drive a Formula One car."[598] The on-track racing no longer threatened to interrupt F1 competition at Spa – that was committed by administrative participants and staffers from the EU.

As BE garnered more wealth and power through bold transactions to control both race organizers and even more so the media's broadcast of F1, he also enriched Formula One Constructors Association (FOCA) owners all the while frustrating FIA leadership at every juncture. Advertising on cars and all along the racetrack "guaranteed lengthy exposure and the public's awareness of Formula One would grow, multiplying the sponsors' fees to the

[598] Henry, *Grand Prix Circuits: A Tour of Formula 1 Circuits from Starting Grid to Chequred Flag*. Page 81

teams."[599] That said, there were two long-term owners who were envious of BE's continuously growing wealth and power and felt they deserved more than the millions they had already received because they were actual competing teams not the person managing the business. Ken Tyrell never liked or trusted BE or his methods and his explosive temper frequently created tensions among the owner group. Ron Dennis is widely depicted across the literature as greedy and not above nefarious activity against BE through others. It is important to recall that BE, on several occasions in years earlier, had offered to FOCA members a part of the proceeds for some involvement in operational matters. Those offers were ignored at times and rejected at others because they cared about racing, not running a business. His perennial "self-justification was to ask, 'Where were they at the beginning? They didn't make the investment at the time. They signed away their rights in 1992. They weren't entitled to it later.'"[600] Things came to a head in the 90s as BE was attempting to float a financial offering of F1 ownership worth billions.[601] A central actor in this saga was Belgian Karl van Miert who was EU Competitions Commissioner.

Van Miert had received complaints about BE and his management of F1 from, among others, Ron Dennis (likely with Ken Tyrrell's prodding) regarding monopolistic practices and conflicts of interest representing FOCA to FIA and other negotiations while also being on the FIA Executive Committee. With those complaints in-hand he vigorously pursued the evidence and among the details his team discovered in F1 documents, "an interlocking web of agreements facilitating [BE's] control of a business which excluded competitors"

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[599] Bower. Page 128
[600] Ibid. Page 205
[601] Actual figures change with different sources and how they were calculated. This was common to any financial endeavor BE might enter.

thus Formula One Holdings was ‘abusing its dominant position to favour Formula One’ with its ‘restrictive clauses in its contracts with the circuits prevented any non-Formula One races.’”[602] Further, BE’s ten year agreements violated EU rules limiting contractual obligations to five years. In exploring why van Miert had embarked on this seeming vendetta he uncovered that it was because of the pending tobacco advertising ban. In December 1997, the Flemish socialist government banned F1’s tobacco sponsorship to which BE responded by cancelling the 1998 Grand Prix of Belgium at Spa which is in the French-speaking Wallonia. The prospect of losing the equivalent of $27,000,000 every year propelled local government to repeal the ban which caused the Flemish commissioner to break EU rules and publicly criticize F1 in the Wall Street Journal. The EU saga had much more intrigue but would, again, pull this narrative out of scope too far. Suffice it to indicate that van Miert formally issued his judgement against BE however resigned months later with other EU commissioners under the cloud of financial misappropriation. The one other time that Spa sat empty was in 2006 when the organizer for that year went bankrupt and the Intercommunale could not react in time to form a fiscal safety net. During that same timeframe, complete reconstruction of the paddock area became necessary to accommodate several new rule changes regarding pit roads and garages.

[602] Ibid. Pages 222-223

5.6.1 Eau Rouge

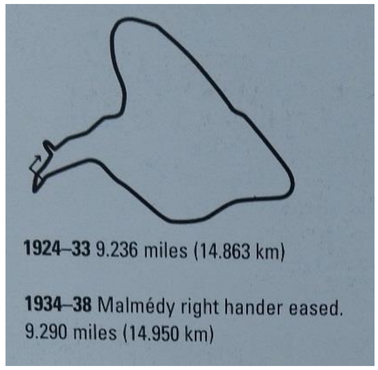

Fig. 5-12: The hair-pin is the small extension on the left side of image. Image from *World Motor Racing Circuits*, Peter Higham, page 169

Any recounting of Spa-Francorchamps would not be complete without an elaboration on the Eau Rouge segment. Also, textual or two-dimensional visual representations are an injustice to this segment of Spa but hopefully this effort will do its best. Until 1939 the race flowed steeply downhill from the La Source hairpin toward the creek known as Eau Rouge for high iron content in the sediment. At that point the road turned left for approximately 100 meters followed by another hairpin over the creek then up a steep curved uphill climb. In 1939 the hair-pin was eliminated and the track modified to a left-hander, followed by sweeping right curve ascending to a blind left-hander prior to a long uphill straightway. That new segment rose the equivalent of a 14-story building (40m/130ft) over a horizontal space of a bit more than 200 meters. At the summit of this feature, the name Raidillon was ascribed thus the entire complex became known as Eau Rouge/Raidillon. Treacherous for the experienced and highly skilled, it ended many driver ambitions for a podium finish as

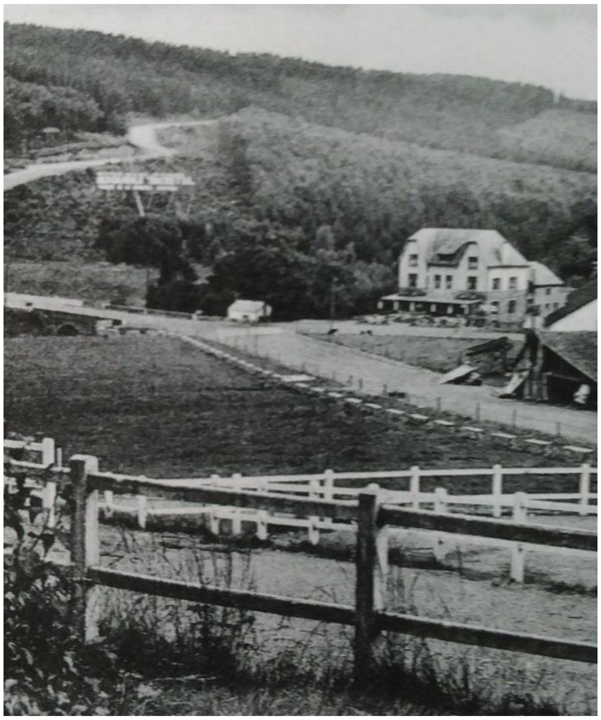

Fig. 5-13 (a) and (b): Dramatic change over time at Eau Rouge

On the left (a) is Eau Rouge in 1947 with the hotel. Courtesy the book: *Spa-Francorchamps, Une Histoire*, page 61

On the right (b) is the same Eau Rouge in 1997. Both hotel and seating area on right side of track are gone. Author and father were in the now removed stands for 1972 non-F1 race. Courtesy commons.wikimedia.org.

it became, "one of the most challenging corners on any circuit in the world."[603] Approaching the bottom, drivers entered the complex at about 180-mph resulting in their bodies being subjected to 4G lateral and more than 2G compressive forces. After making the tortuous 17-degree climb, the feeling of weightlessness took over, or as F1 World Champion relates, "As it gets to the top, it goes very light."[604] It is appropriate that he also

[603] Henry, *Autocourse: 50 Years of World Championship Grand Prix Motor Racing*. Page 84
[604] Mansell. Page 112

has the final say about Eau Rouge in that it was/is, "one of the most sensational sections of track anywhere in Formula One."[605]

5.7 CONCLUSION

In this timeframe, it has been shown how system growth was replete with reverse salients and critical problems to resolve. Active participants were required to react to both regulatory and technical obstacles in order to successfully maintain their place among the top levels of M/S.

From the growth standpoint, both NASCAR and F1 physically grew on demographic and geographic fronts. Regarding demographics, the management of media broadcasting by Bill France, Jr. and BE grew M/S by opening the experience of watching competitions to markets that had not yet had access. For NASCAR, it meant targeting the western Unites States which would deliver results in the next phase from young men who grew up driving go-karts while observing professionals at the highest level and imagining themselves doing the same. For F1 it was providing a visual experience to populations that may not yet have had an opportunity to encounter an F1 event. Even the horrific tragedy at Imola did not dampen interest in F1 as the television audience for the following race increased 20%.[606]

The geographic growth mirrored the demographic by adding locations beyond the existing norms, expanding the possibility to share, in-person, the socio-technical community that meant being an enthusiast participant, of the trek to the race, of being with like-minded spectators in seeing, and learning about, new technologies. This phase also met with the

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605 Ibid. Page 111
606 Bower. Page 167

return of WGI and Spa following years of modifications in order to adapt to the changes of faster and more complicated cars. Track infrastructure needed to grow to accommodate electronics and communication systems for better team management and in some spaces, lighting was added for night races.

The experience at home grew with the advent of real-time race graphics based on GPS technologies. This enabled enthusiasts who could not attend the event in-person to nonetheless be informed on the status of their favorite driver, follow his success or commiserate in disappointment. The act of being a driver became a quasi-shared experience with in-car cameras. As technologies in the disparate realms that would touch M/S evolved, there was growth with a new subset of specialty firms and spinoffs. This scenario is bolstered by the fact that in the MSV in 1958 there were ten specialty M/S firms employing just over eighty people but in 1986 those same ten companies employed more than 1,660 people and that more than 50,000 employees in the United Kingdom worked in the M/S industry.[607] Figures for the Charlotte area with respect to NASCAR are unclear but likely not too far behind MSV.

There was process growth as well. Over these two decades crew member skills grew as technologies were invented that required greater understanding of scientific principles and methods.[608] No longer was it acceptable to just be a mechanic but it was necessary to have the tacit skills using one's senses coupled with the formal education of becoming an engineer.[609] That was borne out by Alan Kulwicki winning a championship as an

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[607] Henry. Pages 27-28

[608] Polanyi.

[609] Carlos Martinez-Vela, "Speed Matters: Innovation in the Nascar Motorsports Industry," in *Annual Luncheon of the North Carolina Motorsports Association* (Speedway Club at Lowe's Motor Speedway, Charlotte, NC2007). Page 11. See also, Henry. Pages 202-204

engineer/driver and by Steve Matchett as an engineer who became an F1 champion mechanic learning about special tools of testing rigs required to maintain the active suspension innovation.[610]

Clearly, not every team or track met with success as reverse salients delayed or derailed advancement. Simtek and Lotus were F1 teams that could not keep pace with technology and finances thus fell by the wayside. Neither of the imposing behemoth circuits of N-ring (previous chapter) or Spa could maintain their place on the F1 calendar until many critical problems were resolved as happened with Spa.

The attempts at designing incredible systems to either assist drivers or maximize efficiency themselves became reverse salients. Some teams (like Ferrari) could not adapt technically but had sufficient political power to block F1 "Gizmo cars" thus restoring some degree of equanimity to the series. Other ventures went to the technological extreme with RB like the Chrysler Patriot but never materialized while the Panoz "Sparky" did race but was ahead of its time.

Further, the application of scientific methods to create carbon fiber chassis and components highlighted certain Schumpeterian aspects manifest in M/S. McLaren devised a way to shape CF first into body parts/chassis then suspension parts. As happened with Cooper's mid-engine and Chapman's monocoque as well as his aerodynamics advances, this new technology made a huge impact on the existing structure of F1 – and eventually all of M/S and automobility. Those that could not follow suit disappeared.[611]

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610 Vincenti. On special tools see pp. 181-186
611 Schumpeter. On impacting existing business structures see page 87.

The critical problem of excessive danger from high speeds on NASCAR superspeedways was met with the implementation of restrictor plates. However, the unintended consequence to the application of this method created a new controversy in NASCAR – pack racing. By narrowing all cars to the same horsepower and acceleration a new form of racing emerged that discomfited drivers and disrupted air-flow in such a way that it spawned a new mandate requiring spotters and two-way radio communication.

What became noticeable over time was that heterogenous networks were forming. By way of comparison we can think back to the Portuguese Prince Henry the Navigator. He wanted Portugal to have a share of the wealthy spice trade in the 1400s by using the sea, not over land. His "school for exploration' in Sagres, Portugal" taught mariners from all parts about celestial navigation.[612] The galleys used in the Mediterranean were useless in open oceans so new vessels called caravels were developed thus new shipyards and woodcraft techniques were learned. Learning how to pilot a caravel in a storm required learning new skills and men to teach it. Understanding gyres and ocean currents required further expertise and places to teach. The dynamics of that network were constantly changing but Portugal was the center for some time.

The networks of M/S were likewise reliant upon many factors. Teams were required to respond to climatological changes, regulatory nuances, technological advances and failures while still developing a competitive car to win races. Spectators went and bought tickets to watch in-person. Sponsors funded teams to develop greater speed and control as those same spectators bought the products sponsors and advertisers made. Specialty firms grew to

[612] Denny. Page 147

support the ever growing need for new machinery or equipment to craft tools and components. As members joined teams, they were expected to have the requisite credentials as engineers in addition to some experience to draw upon. The media became vital to sharing the experience not just as an onlooker but also with graphically depicted data and in-car cameras. Especially with F1, it was BE's mercantilist approach toward the media business and his acquisition of it that spurred the sport's growth.[613]

Both F1 and NASCAR became dynamic networks as more nodes were continuously added while others vanished from inability to meet the constantly changing technical requirements and spectator desires. The locus for these two networks (MSV and Charlotte, NC, respectively) not only did not change, they grew as centers of production and labor. People moved around taking with them any knowledge into the new jobs. Castells eloquently relates, "the changing dynamics of networks, and of each specific network, explains the connection to certain places rather than the places explaining the evolution of networks."[614] As this story advances to the next stage, these networks became more distinct and overt.

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[613] On the study of mercantilism see, Eli Hecksher, *An Economic History of Sweden*, trans. Göran Ohlin (Cambridge: Harvard University Press, 1954). See also, Ronald Findlay, et al., ed. *Eli Hecksher, International Trade, and Economic History* (Cambridge: The MIT Press, 2006). "The ultimate *goal* of mercantilist policies was to maximize the external power of the state." Page 234. Replace the word "state" with "Formula One".

[614] Castells, *The Rise of the Network Society*. Page xxxv.

CHAPTER VI: MOMENTUM – EARLY 2000S – 2010

Manuel Castells writes that, “Because information and communication circulate primarily through the diversified, yet comprehensive media system, politics becomes increasingly played out in the space of media. Leadership is personalized, and image-making is power-making.”[615] This statement is an important commentary with respect to M/S and will be shown as central to the narrative further below.

By this time organized, professional M/S had survived its development, had grown, and was experiencing substantial momentum whereby there were no longer truly radical innovators or inventions, it became incremental. Furthermore, as the heterogeneous networks F1, NASCAR, and WEC developed strong actors and sets of actors who were not always in agreement on matters of great substance, they had developed a unified culture transcending all series. Regulatory control, safety, technological advancement or curtailing it, were all passionately debated between administrative (FOCA, FIA, the EU, NASCAR, race organizers, track owners etc.) and active participants (GPDA, team owners, drivers, etc.) as well as among enthusiast participants through broadcast media.[616] With the help of broadcast media, F1, NASCAR, and WEC had all become multinodal global networks around the technological advancements in M/S and their race spaces as the systems grew. The American Daytona 500 had for many years hosted large international press pools, plus

[615] "The Global Network." Page 623.

[616] Hughes, *Networks of Power : Electrification in Western Society, 1880-1930.* Ibid. In Hughes monograph about utilities he writes, “The tension between the utilities and political institutions such as local governments was high during this phase of systems development.”

F1 and WEC races resembled automotive United Nations sessions with a dizzying myriad of languages spoken.

Continuing with the customary chapter format to this point, supranational matters which had an impact on M/S will be discussed first. The horrendous tragedy that was 9/11 left its imprimatur through travelling restriction hardships. The late-decade “Great Recession” left a global financial injury which prevented enthusiasts from attending at all and ending some M/S organizations’ existence. The realization of the European Union on one hand simplified matters in Europe while on the other, its bureaucracy stifled activities in the minds of F1 leadership. The most influential decision for M/S was the elimination of tobacco advertising in M/S in any way. For NASCAR it also saw the parting of the ways with the RJ Reynolds sponsorship of Winston Cup as the use of tobacco had been falling sharply out of favor.

The environmental footprint of M/S started to truly matter in this decade and began taking shape. The FIA began several initiatives for the “greening’ of the sport as well as automobility in general. In addition, it formed alliances to help improve safety and driving conditions across the globe. NASCAR made an overture to its relationship with the environment.

Within the sport itself, technical innovations included the evolutionary turbo-diesel in WEC that won handily, F1 steering wheels had transformed from round objects into active computers with switches, buttons, and read-outs, and paddle-shifting through gears instead of using a foot-operated clutch and gear-stick.

Lamentably, it was also a decade of tragedy in M/S despite efforts to mitigate the issue. The result was implementation of two methods which had been in the works for several years. The most widely adopted was the Head And Neck Support (HANS) device and the second was primarily for American oval racing with the Steel And Foam Energy Reduction (SAFER) barrier.

Finally, the two remaining circuits to examine will then be profiled. They are situated here in this chapter because they were emblematic of momentum as is the central theme of this epoch. Neither were removed from any racing calendar and neither required any massive excavation or construction to upgrade safety or technology as did the previous. Monaco was already a tourism destination in the early 1900s and racing began there in 1929 but has retained essentially the same shape and space over the intervening years. Organized racing began at LeMans in 1923 and, with several incremental modifications, also remains much the same configuration almost a century later.

6.1 THE MACROVIEW

There is no way to avoid a brief discussion about the unspeakable events that took place on September 11, 2001. However, so much has been written and said with memories fresh in our minds of where we were and what we were doing at the time, that only this brief acknowledgment will be conducted. Insofar as its impact on M/S the reaction was Janus-like, on the one hand there was massive sentiment of being respectful for several months thereafter because it was so earth-shattering. On the other, the feeling was also to be respectful and give the issue time but that a return to normalcy as soon as possible was equally important. In America the latter came to the forefront as, for example, the Atlanta

Braves and the New York Mets played a baseball game in New York just ten days after the calamity. It was referred to by the media as a healing event because, in a story-book fashion, the Mets' player Mike Piazza hit a game-winning two-run home run late in the game. For NASCAR it was two days later at the 400-mile race held at Dover, Delaware, about 100 miles from the Pentagon site and 150 miles from New York City. An intensely emotional and patriotic atmosphere, it was won by Dale Earnhardt, Jr. What made that special for all enthusiasts was that "Dale Jr." had been consistently voted as the fans' most popular driver plus this victory came seven months after his father was killed at Daytona – a double healing moment in the words of the media. The major effect that 9/11 had on M/S was to complicate air travel by enthusiasts to attend far away competitions.

At the millennial turn, after everyone had survived the Y2K hysteria that all computer clocks would revert back to the year 1900 instead of 2000, came the actual realization of many years of work to form the European Union as a viable organization and to place a central currency of the Euro on at least an equal footing and fiscal strength of the US dollar. At the macro-level of capital markets and large international banks there was concern of the reduction in the number of banks and massive continental stock market exchanges, to name but a few.[617] With the pervasive sponsorship by corporations and companies of hundreds of M/S teams in various series, this potential fiscal imbalance was a hugely significant issue for active participants. That said, while there were several bank mergers it was not as chaotic as presumed. Laying the groundwork for this pan-European single currency, the euro, was not easy either culturally or mechanically (financially speaking). Some countries did not have the history of financial responsibility or stability (Greece) and

[617] Gillingham. Page 465

others simply wanted to retain their own currency. As Judt explains, "the real issue is not the euro but Europe – or more precisely, the European social model. The English (unlike the Scots) still don't feel very European."[618] This was important to the greater MSV for its large base of international employees (some from the EU and some not, thus new human resource policy issues) and the wide-ranging international customers of the several of suppliers of M/S components.

In order to accomplish the tasks of building a sound foundation for the euro, years of planning were required. In June 1997, the, "[Exchange Rate Mechanism II] was established to stabilize exchange rates…[resulting in] a remarkably smooth changeover at the beginning of 1999…[and] was completed smoothly as well at the beginning of 2002."[619] This mattered greatly to all M/S participants in Europe because of mobility, the free movement of persons, goods, and funds across national borders and jurisdictions. For many it was good, but for the frontier districts, especially in and around the Ardennes and Eiffel areas of the Belgo-Franco-Luxo-German portion of Europe where Spa and the N-ring sat, the loss of customs jobs was painful and added supporters to the nascent nationalist political movements angry at "Europe" and "them".[620] As it pertained to F1 and WEC, most of the teams were based in the MSV west of London but were genuinely international, especially the drivers. For many of those team members home and citizenship was in another country as they maintained a flat or a *pied à terre* while they were required to be at headquarters. Crew members had relocated to the nearby villages again whilst

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618 Tony Judt, *Reappraisals: Reflections on the Forgotten Twentieth Century* (New York: The Penguin Press, 2008). Page 228. A seemingly familiar description.

619 Barry Eichengreen, *Globalizing Capital: A History of International Monetary System* (Princeton: Princeton University Press, 2008). Page 221

620 Judt, *Reappraisals: Reflections on the Forgotten Twentieth Century*. Pages 412-413

maintaining non-UK citizenship which was allowed under the new rules. With the EU there formed a seamless method, “making technical credentials and pensions more portable, making employment relations more flexible.”[621]

On the financial front as it impacted M/S, the largest corporate bankruptcy in history was filed in mid-September 2008 by the Lehman Brothers, a huge investment banking firm on Wall Street. With about $640-billion in assets, they also had almost as much in debt which was an untenable financial perch. The domino effect was stunning and wide-ranging globally having begun with another Wall Street investment banking firm, Bear Stearns, failing earlier that year. Fiscal devastation became rampant with the percentage value decline greatest in western economies of the United States and Europe because banking systems were intertwined with business for corporate bonds, loans, capital expenditures, etc. The American stock market Dow Jones Index was slashed by half of its value in just a few months and by extension, that damage flowed directly into the M/S domain as well.

In F1, the Honda factory team announced its withdrawal for the 2008 season which rendered about 700 employees in England temporarily unemployed but most were quickly absorbed across the M/S community around the MSV. In WEC, the championship team from Audi withdrew effective the 2009 season, also because of the financial crisis.[622] With NASCAR it was a much bleaker scenario as ticket sales plummeted anywhere from a ten percent decrease to as much as twenty percent at the 2009 Daytona 500.[623] Additionally, many smaller or marginal teams contemplated their futures and several of them chose to

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[621] Eichengreen. Page 225
[622] Tim Webb, "Is Formula One on the Skids?," *The Guardian*, 6 December 2008 2008.
[623] Ben Berkowitz, Berkrot, Bill, "Analysis: U.S. Economy, More Than Scary Crashes, Threatens Nascar," *Reuters*, 1 March 2013 2013. A family of four would spend thousands of dollars for a race weekend.

merge operations which, as is always the case, resulted in approximately 1,000 employees becoming functionally redundant although not technologically unemployed because it was not technical innovation that usurped their positions.[624]

6.2 MOTORSPORT AND THE ENVIRONMENT

This decade brought with it an attitudinal sea-change by administrative participants regarding the FIA's responsibility and accountability to reconcile and lead the debate triangulating M/S, environmental awareness, and automobility. The term environmental here represents both the biological and/or natural as well as the operational *endroits* across the world where vehicles were operated haphazardly and posed health threats to both pedestrians and drivers moving from point "a" to point "b". The prime catalyst for this ideological conversion about M/S technology and the environment was Max Mosley when in 2006, as president of the FIA, he announced that F1 in particular needed to restore itself as the pre-eminent innovating entity for all things automotive as had been claimed for years. He categorically re-affirmed this during a speech at a 2007 motorsport conference in Monaco stating, 'It is necessary to demonstrate to society that F1 is doing something useful, and it is essential for F1 teams to be able to demonstrate to major companies that they are able to really make a contribution.'"[625] So, what actions did M/S organizations take?

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[624] Bernard Simon, "Nascar Feels Impact of Recession," *Financial Times*, 7 April 2009 2009. Technologically unemployed means loss of job through machinery or technology that replaces human work in production.

[625] Westin, "How Green Was the Flag?: The Maturation of Motorsports' Relationship with Automobility and the Environment." Pages 16-17. For Mosley quote see, Guy Richards, "It's Green for Go," *Engineering & Technology* 3, no. 20 (2008). Page 45

Let us begin with the simplest – solar powered. This was a series that has been in existence since the 1980s and is still going strong today with the majority of competitors coming from universities. Next, F1 banned all refueling (for the second time in twenty years) effective the 2009 season so the teams needed to recalibrate their designs to make 100 kilograms of fuel last for the duration of a two hour race.[626] NASCAR did not really accept the environmental challenge in that they only converted to unleaded gasoline in 2007. It is unclear whether or not that switchover was related to a 2006 study about lead levels in NASCAR team members which the data showed was elevated.[627]

The FIA, however, had launched a campaign with several initiatives from the beginning of the decade. To begin, the FIA Foundation was established in 2001 so that global mobility would be "Safe, Clean, Fair, and Green."[628] Their mission started by proposing the UN Decade of Action for Road Safety through partnerships with many international NGO's and creating pilot program in eighty countries. Second, the Foundation partnered with another large group of organizations to create the Global Fuel Economy Initiative (GFEI) in 2009 with its charter to reduce man-made climate change and CO_2 emissions caused by all road-based transportation forms that resulted in an extensive report. Like all UN-affiliated long-term reports it was laden with implementation goals and ambitious targets through the year 2050.[629] While seemingly lofty, it provided another roadmap where previously few existed such fifty percent reduction in fuel usage by 2050 through data

[626] Kilogram was (and is) the standard unit of measure for fuel in F1.
[627] J. O'Neil et al., "Blood Lead Levels in Nascar Nextel Cup Teams," *J Occup Environ Hyg* 3, no. 2 (2006).
[628] For more information please see, https://www.fiafoundation.org/about-us
[629] Staff, "50by50," (Global Fuel Economy Initiative, 2011). For more details please see, https://www.globalfueleconomy.org

modeling, policy development, engagement of stakeholders, information dissemination, education, and communication. More directly to the point, then President of FIA, Max Moseley announced in 2006 of the need for F1 to "restore itself as the "pre-eminent innovating entity for all things automotive"[630] which he re-affirmed in a speech at a 2007 M/S conference in Monaco with, "It is necessary to demonstrate to society that F1 is doing something useful, and it is essential for F1 teams to be able to demonstrate to major companies that they are able to really make a contribution [toward the environmental issues]."[631]

Track related matters had different constituencies and actors such as the English Motorsport Industry Association (MIA) which was created in 1994 as a trade association for M/S. In 2002, they published a report titled "Energy Efficient MotorSport" for the purpose of finding ways to influence creation of series or series sub-categories promoting efficient yet competitive M/S events.[632] The literature of M/S does not specifically identify this report as the catalyst for the development by Audi and Peugeot in 2005 of turbo-diesel cars in the LeMans Prototype (LMP) category, but, because of their relationship with the FIA, it is likely that it helped elevate the process. The Audi R10 TDI was the first to compete at LeMans in 2006 and it won its inaugural fight. The Peugeot 908 HDi FAP first raced at LeMans in 2007 but would not win until 2009 when it was victorious over the

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[630] Westin, "How Green Was the Flag?: The Maturation of Motorsports' Relationship with Automobility and the Environment." Page 16

[631] Richards.

[632] Staff, "A Feasibility Study into the Role Motorsport Can Play in the Development of Energy Efficient Autromotive Technologies," ed. C Aylett (Warwickshire: Motorsport Industry Association, 2002). For further exploration please see, https://www.the-mia.com.

“next-gen” Audi R15. However, propulsion by turbo-diesel was not new to racing just not as noisy as the conventional opinion was of diesel.

David Edgerton ably categorizes the reason for the narrative of turbo-diesel in M/S when he informs that, “We do not have a history of invention, but instead histories of the invention of only *some* of the technologies which were later *successful*.”[633] Does that bias our understanding of the history of turbo-diesel in M/S as he claims it would? Perhaps, but it also helps, or should help, to remind us to explore further into the annals of history in order to learn whether a novel technology is revolutionary or evolutionary to again bring in Basalla’s concept. Racing a turbo-diesel car was first attempted in 1952 when Fred Agabashian drove a car powered by an inline, six-cylinder, 400-HP, minimally modified Cummins turbo-diesel truck engine at the Indy 500 and astoundingly qualified on the pole.[634] Was it a shameless marketing ploy by the Cummins management? Yes, and they did not care for what should be obvious analytical reasons. A much heavier front-loaded vehicle, it continuously “pushed” into the corners but Agabashian was a veteran driver so he was able to maintain his position near the front. Unfortunately, the non-engineer crew who built it were employees at the Cummins factory and they mounted the air intake too low on the engine resulting in it sucking in the debris and detritus from the track which, in turn, caused catastrophic engine failure.

Another effort to improve M/S’s relationship with the environmental movement occurred in the previously discussed ALMS in 2008. Assigned the name Michelin Green X Challenge after its sponsor, the purpose of the race within a race was to provide an

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[633] Edgerton. Page 184, italics in original.
[634] D. Kennedy, Olson, J, "Cummins at the Indy 500 - Diesel Alley," *Diesel Power*2008.

experimental category for teams to safely use alternative means of propulsion while also remaining competitive. Those fuel substitutions included direct injection, low-sulfur liquids, natural-gas-to-liquid, gas/electric hybrids, flywheel hybrids, electric wheel motors, E10 ethanol, cellulosic E85, and isobutanol. Points were calculated based on three factors: 1) fuel type and emission related measurements, 2) speed, and 3) efficiency (fuel-economy).[635] The sports car series in America had undergone multiple changes over the past decades to include mergers and re-categorization of classes thus the Green X Challenge began in ALMS and ended in 2017 in the IMSA (International Motor Sport Association) WeatherTech Championship.[636] That stated, a strong relationship continued to exist with the U.S. Department of Energy, the EPA, and SAE International.

Motorsports overall was slow to react to the burgeoning list of questions and demands of both its internal constituents and external non-consumers of the sport when it came to environmental awareness and accountability. Whether these efforts were enough to mollify critics would depend upon future actions. Those actions will be revealed in the next chapter.

6.3 THE SPORT

During this phase, all three top-level series encountered the usual myriad changes on technical rules, sporting rules, and homologation updates so stabilization and momentum were essentially synonymous. However, there were three majorly impactful circumstances that would permanently alter the course of M/S – safety, sensors, and tobacco. Under

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[635] The initiative into hybridity is more pertinent to this chronicle than individual race results.
[636] WeatherTech was (and is) an auto accessory manufacturer.

safety, events that unfolded in 2001 would lead to the requirement that all drivers in all series to wear a HANS device and that all tracks in the U.S. install SAFER barriers along the concrete walls of the track's perimeter. Under sensors, tiny transceivers and radio-frequency identification (RFID) transmitters became pervasive in monitoring all manner of pressures, temperatures, stress, etc. and communicating that data to not just the paddock and the crew but also to team headquarters in a distant place. Finally, under tobacco this was the period when tobacco advertising in F1, NASCAR, and WEC would finally end. This led to teams needing to find other sources of funding the multi-million dollar efforts just to field a team regardless of success.

In the sport of NASCAR, the ultimate goal was to win the Daytona 500, the sports inaugural event for the season. It is an endurance race contested at maximum velocity of almost 200-mph for at least 250 laps.[637] Racing careers were solidified with this victory and one was forever immortalized at any speaking events as a Daytona 500 winner just prior to their name. There have been Winston Cup (WC) series champions who never won that marquee race and one of them was seven-time WC champion, Dale Earnhardt. It was not until his 20th Daytona 500 attempt in 1998 that he finally took the checkered flag and as he rolled toward Victory Lane, every crew member from every team formed a line along pit road to congratulate him as the unofficial and unelected chairman of that community. Circumstances were much more dire three years later when he was killed in a last turn crash that should not have had the outcome it did and which set into motion a sequence that permanently altered M/S at all levels worldwide.

[637] Sometimes races went beyond 250 laps due NASCAR's rule change years ago to not end under the caution flag.

In less than eighteen months from September 1999 to February 2001 NASCAR suffered the loss or permanent disability of at least four drivers from traumatic brain injury or basilar skull fracture. Ernie Irvan had been one of the fiercest competitors consistently leading laps until he nearly lost his life at the Michigan Speedway in 1994 and then again in 1999 at the very same venue from severe concussive effects and collapsed lungs. In May 2000, fourth-generation driver Adam Petty (aged 19) was killed at the Loudon, New Hampshire facility and eight weeks to the day so was another young driver,[638] Kenny Irwin, who passed away from the same cause at the same track.[639] This particular fatal injury occurred during an oblique, high-velocity, high-speed impact with a solid, immovable object which caused a whipsaw-like motion of the neck and head with added weight of a helmet. Like the two young men preceding him, Earnhardt’s death could have been prevented but his resistance to change obscured his perspective. As another indicator of Earnhardt’s recalcitrance to follow the modern safety guidelines, he would be the last driver to eschew the open helmet and goggles for a full-face helmet protecting everything above the neck and which would later incorporate drinking tubes for drivers to hydrate with liquids from coolers in the compartment.

The 15 February 2001 *Orlando Sentinel* provided a timeline of the development for the Head And Neck System (HANS) device which began in 1980 Atlanta when race driver Jim Downing asked his biomechanical engineer brother-in-law, Dr. Robert Hubbard to

[638] Adam Petty was the son of Kyle Petty (see his commentary on Kulwicki in previous chapter), grandson of seven-time champion Richard Petty, great-grandson of NASCAR champion Lee Petty

[639] J. W. Melvin et al., "Crash Protection of Stock Car Racing Drivers--Application of Biomechanical Analysis of Indy Car Crash Research," *Stapp Car Crash J* 50 (2006). See also, Weaver et al.

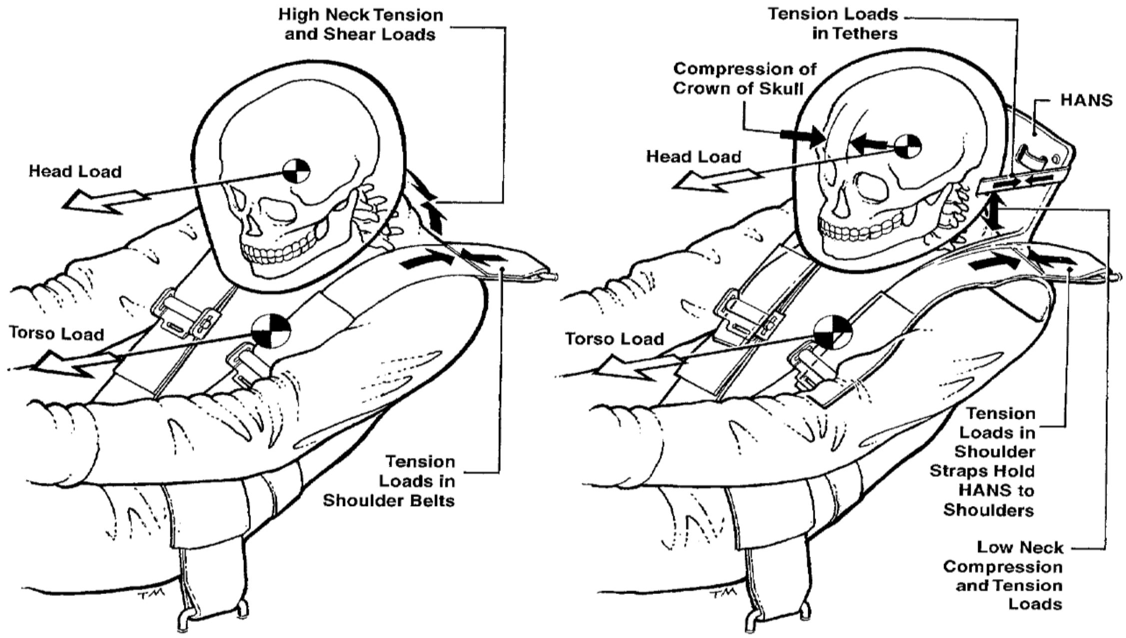

Fig. 15.5 HANS operation.

Fig. 6-1: HANS device. Diagram from *Formula 1 Technology* by Peter Wright, illustrated by Tony Matthews. Used with permission from Peter Wright.

develop a better helmet.[640] By 1987, Hubbard had earned a patent on the device and two years later Downing was wearing it at IMSA races but it was bulky and nobody else wanted to try it. In the mid-1990s Kyle Petty wore one until NASCAR rule changes to the window aperture shrunk thus complicating rapid egress or forced extrication. This was followed by partnering with Mercedes-Benz for F1 and Indy-cars then later with GM for NASCAR test-sled data.[641] From a sport governance vantage in 2000, CART (for open-wheel Indy cars) mandated HANS for all drivers in 2001, F1 required the device for all drivers as of 2003.[642]

640 *Orlando Sentinel*, 15Feb 2001, Box 3, Folder: Greg Moore, Accession 99A72, John Fitch Collection, IMRRC, Watkins Glen, NY

641 Hubert Gramling, Hodgman, Peter, Hubbard, Robert, "Development of the Hans Head and Neck Support for Formula One," in *1998 SAE Motorsports Conference* (Society of Automotive Engineers, 1998). Folder 1998 SAE M/S Conf., Accession 02A14, Hubbard Collection, IMRRC Archives, Watkins Glen, NY

642 Hubert Gramling, Hubbard, Robert, "Sensitivity Analysis of the Hans Head and Neck Support, 2000-01-3541," in *SAE Motorsports Engineering Conference* (Society of Automotive Engineers, Inc., 2000). See also it comparison for F1 airbag, "Development of an Airbag System for Fia Formula One and Comparison

In NASCAR, however, it continued to contemplate as a few chose to wear the device but most were not comfortable with such a significant change just before the "Great American Race" as the Daytona 500 is often referred to.[643] As a counter-proposal to the HANS device, John Fitch had developed a capsule system. Since the mandatory implementation of the HANS device (with upgrades and series-specific modifications) there has not been a basal skull fracture fatality in M/S despite increasingly powerful and violent crashes.

Fig. 6-2: John Fitch's "capsule" proposal countering the HANS device. Box 3, Folder: Envelope from J. Fitch to Carl Goodwin postmarked 29 Jun 2001, Accession 99A72, John Fitch Collection, IMRRC, Watkins Glen, NY

A second element to the death of Dale Earnhardt was the structure itself of a solid, thick concrete wall. The generally accepted thinking of the time was that no alternative superstrata to concrete could capture the velocity of M/S vehicles and safely mitigate racing accidents. While noble in its archaic framework, there had been research and development for precisely those alternatives that would not only absorb the forces of the crash but would dissipate those forces across a broad area. As early as 1994 John Fitch had been finalizing

to the Hans Head and Neck Support - 2000-01-3543," in *SAE Motorsports Engineering Conference* (2000). Both on CD, Accession 02A14, Hubbard Collection, IMRRC Archives, Watkins Glen, NY

643 Rogers. Specifically regarding change agents and resistance to change.

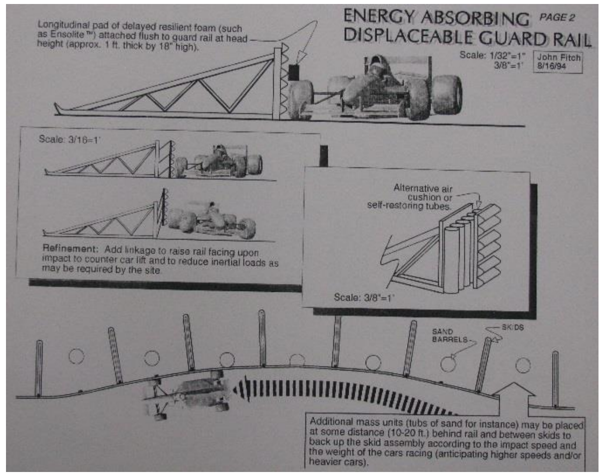

Fig. 6-3: Energy Absorbing Guardrail by John Fitch (1994). Box 3, Folder: Impact Dynamics, Accession 99A72, John Fitch Collection

development plans for a barrier that would displace the energy from an out-of-control racecar at high speed. Drawing from his nightmarish experience at the 1955 LeMans disaster involving his Mercedes-Benz teammate Pierre Levegh, he was highly focused on the issue of driver and track safety. Whether he saw the bodies with burning magnesium is unknown but the entire sensual experience was certainly etched in his mind thus his determination for safety improvements. Although Fitch proposed a different solution, the end product that was selected became known as the SAFER barrier. However, it was not a rapid implementation.

The politics of safety by this time had become too contentious for administrative participants to ignore as long-term agreements for media rights had moved to the forefront and lapses in safety were shown live as they happened to the enthusiast audience. In the United States it was with multi-year contracts between one of the four major broadcast networks and NASCAR while with F1, BE had consolidated his stranglehold control of media rights that transmitted any incident to a global audience greater than 50-million people per race. With the hue and cry from all corners of the enthusiast and active participant community about the need for safety improvements, research had already commenced to establish some form of safer barriers at ovals and sturdier barriers for road courses. The walls that comprised the exterior perimeters of oval circuits were an unforgiving concrete edifice and crashes were happening at much higher velocities than when initially constructed because cars were faster and with greater mass. On road racing circuits, the tire barriers near likely crash sites would not have been considered inadequate for minimizing impacts for the most part but it was the issue of, a) getting to the driver to check on his condition without negotiating an obstacle course of jumbled tires, and b) the matter of then restoring an effective barrier after the incident, that was problematic.

First to the SAFER implementation. As indicated, attacking the hard wall issue was pursued on three fronts by different entities. John Fitch had his concept of a displaceable guardrail, the Indy Racing League had invested in developing a system known as Polyethylene Energy Dissipating System (PEDS), and the third at the Midwest Roadside

Fig. 6-4 (a) and (b): Observed Impact Delta on early 2000s cars. On the left (a) obliquely impacted concrete wall at 140-mph and on the right (b) obliquely impacted SAFER barrier at 148-mph. Image courtesy Sicking, et al. page 58

Safety Facility under supervision of Dr. Dean Sicking at the University of Nebraska – Lincoln. A concern with Fitch's system was the potentiality of ricochet wherein the vehicle impacted the barrier and the flexion properties responded by catapulting that vehicle, and any other car/object, across the tarmac in the racing line with equal velocity as the barrier snapped back into position. The PEDS system was actually installed at the Indianapolis Speedway for the 1998 International Race of Champions series which was quite fortunate for the Dutch Indy 500 winner Arie Luyendyk who was bumped by Tommy Kendall after his contact with the turn four wall. When Luyendyk's car struck the internal perimeter wall, the PEDS system cushioned a violent impact but it then disintegrated showering table-top sized objects across the entire racing line requiring a lengthy clean-up and repair of the PEDS wall. After considerable testing with race speed sleds and real-world scenarios the SAFER barrier was selected over the others.[644] It became quite obvious that several factors would impede any rapid installation of this system. To comprehend the parameters of why it was financially and logistically impossible to refurbish all oval spaces it is necessary to understand what the system entailed. As exhibited in the schematic below, this system was a complex integration of materials shaped into a particular size and form in order to attenuate the forces of racecars thrust at full song into an immovable object without harming the occupant. First and foremost was the fact that demand far exceeded supply.

[644] D. L. Sicking, Reid, John, et al., "New Energy-Absorbing High-Speed Safety Barrier. Paper 03-2218," *Transportation Research Record* 1851 (2003).

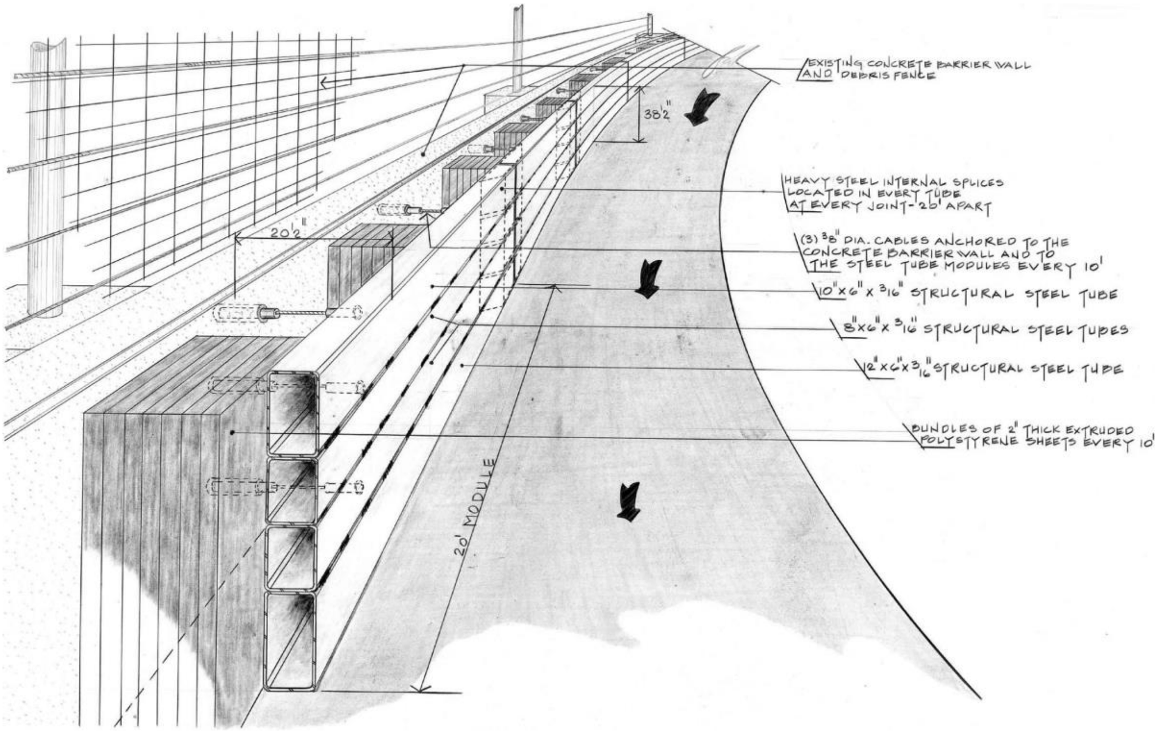

Fig. 6-5: Schematic of SAFER barrier system. Image courtesy Sicking, et al., page 58

Each foot of SAFER barrier cost approximately $500 and required "two to three months to retrofit from ordering the materials, perfectly fitting the steel tubing to the existing barrier, and a two to three week instillation.[sic]"[645] Consequently, NASCAR had to examine historical data and then selectively install these barriers at the most likely points of impact. There was a staggered pattern in placing these systems at all tracks that dragged on well into the 20-teens until a rash of incidents at unprotected wall sections with high profile names like Denny Hamlin (broken vertebrae), Jeff Gordon (concussions), Danica Patrick (multiple collisions) while the most egregious incident occurred in 2015 as it could have

[645] Web blog, Laurel Belman to Lemelson Center for the Study of Invention and Innovation, April 30, 2015, 2015.

been prevented. During the Xfinity race (second-tier series) the day prior to the Daytona 500, Kyle Busch crashed head-on into an unprotected interior section of concrete wall breaking both tibia with compound fracture on one leg. The resulting inquest generated near immediate protection for that section but a) not in time for the next day's race, and b) it later came to embody that driver's resolution and determination in that despite missing several races during recovery he came back to win the Sprint Cup series championship that year in a like manner as Niki Lauda challenged for the 1976 mantle.

For road courses it was less the extreme violence of a heavy car at very high velocity, than the violence of a lighter car at high speed becoming entangled in, or submarining under, the protective tire barriers. That was why the FIA mandated frontal cladding and that tires be bolted together in a woven system versus a net or roping chosen by a local organizer. One of the ideas Fitch put forth to a broad audience was the use of previously mentioned fronting or cladding as advertising space to offset the cost of implementing the bolted

Fig. 6-6: Allianz support of stacked, belted tires. Courtesy IMRRC.

system.[646] The German insurer, Allianz, was in agreement resulting in implementation accords for both cladded tire barriers and polyethylene blocks injected with a flexible density foam. Both systems enabled vehicle capture and simplicity of reconstruction following an incident.

From the innovation standpoint in M/S there were notable safety mandates during this phase. Chronologically for NASCAR, in 2000 tethers were required on hood, trunk, and suspension components to prevent airborne missiles on-track or into spectators. Second, in 2002 it was required that all cars have ADR at all competitions, helmets were mandatory for all pit crew members, and most significantly the establishment of a NASCAR Safety R&D Center. By 2005 the SAFER barrier was mandatory at all critical danger points at NASCAR tracks and drivers were required to use full-face helmets, closing the door on the heritage of “hell-of-a-fellow” with open-face helmets like Dale Earnhardt. Last for NASCAR, an entirely new chassis known as the “Car Of Tomorrow (COT)” was mandated for all teams in effect for 2007 season. Entirely re-engineered by the new R&D Center as a Cup series car, it incorporated numerous driver protection standards that essentially turned the cockpit into a driver safety cocoon. Outwardly awkward in appearance with its wing, it changed the series from that point forward by demonstrating support for driver concerns. Also, ear-piece EDR’s were mandated for the open-wheel Indy Car drivers because of a concern that vehicular readings might not have accurately reflected impact readings and their effect on drivers with subsequent diffusion to other racing series.[647] In

[646] German Allianz insurance company promoting tire stacks. Box AR-L-3, Folder: not labeled, Accession 99A72 John Fitch Collection, IMRRC, Watkins Glen, NY

[647] Minoyama and Tsuchida. See also, Weaver et al., P. L. Jacobs et al., "Physiological Responses to High-Speed, Open-Wheel Racecar Driving," *Med Sci Sports Exerc* 34, no. 12 (2002).

F1 that year, teams were required to add a Kevlar layer on frontal components like wings and diffusers to minimize razor-like shards of carbon-fiber from penetrating competitor tires after minor incursions into one another.

This technological expansion included the proliferation of electronics in both F1 and WEC and to some degree in NASCAR. In the latter series a new element became commonplace for the top tier Cup-series with the appearance of what were referred to as "war-wagons". Since NASCAR operated in the open elements on pit road with garages several hundred feet away, it became necessary to find a way to safely and efficiently set up monitors that displayed not merely broadcast images but also telemetry data from the car. What resulted was a two-tiered artifact whereby the lower section contained tools and any parts that might be needed during a race. In addition, the lower section also housed several computers and, depending on the race location, they would mount satellite receivers in order to monitor weather and track conditions. The upper section became a covered platform with seating for several people and a monitoring station for the crew chief, car engineer plus the driver's

Fig. 6-7: Team "war-wagon" for 7-time NASCAR champion Jimmie Johnson. Notice monitor banks on second level and under the Lowe's logo. Courtesy commons.wikimedia.

wife/girlfriend, and sometimes the car owner. The data shown on those monitors remained to just the local race space unlike F1.

Within WEC and sports car series there were multiple categories of cars all competing in each race. The upper echelon categories like the LMP of Audi and Peugeot mentioned above had close to 90 sensors that delivered well over a thousand data points of live

Fig. 6-8: Red Bull F1 command center displaying multiple screens of data. Courtesy formula1.com

telemetry to the team which required multiple computers and monitors. In F1 there were even more sensors and by this stage each race space was required to have permanent garage buildings on pit road which also included monitoring stations at the pit wall between pit road and the actual racing line. Each of those stations contained three to four seats per car thus with two-car teams which equated to six to eight engineers per team analyzing the live data. Aside from the sensors, another component of this team based network was the euphemistically named steering wheel which because of their sophistication cost fifty to eighty thousand dollars apiece and have only risen in expense since then. No longer a round tiller by which the driver simply piloted the vehicle, it had become an individual command and control center in and of itself. It displayed critical data in text form, warned of potential issues with colored lights, and enabled driver control of multiple settings with buttons and

Fig. 6-9: Team Lotus F1 steering "wheel".Courtesy Wikipedia.org.

settings based upon track conditions, counsel from the car's engineer, or data points from the car's myriad of sensors. As a result each team was required to transport high-powered computers to each F1 race, but why did F1 teams need this much data?

As Peter Wright elaborates, "Measurements are made for three main purposes: 1) display, 2) storage for subsequent analysis, and 3) input to control systems."[648] However it was not only the engineers in the paddock area at the race that were consumers of the live data as F1 had hundreds of employees at the team headquarters who were reliant upon the same data. That information was collected and parsed into larger datasets to create algorithms for modeling purposes to better design components and car body parts as they also tested regulatory limits. The inevitable question would be: what were they measuring and why? As a response, Wright provides a lengthy list that includes[649]:

- Temperature, strain, and acceleration of moving engine parts
- Combustion process and efficiency
- Torque on gearbox components
- Moving surface temperature
- Aerodynamic and suspension loads
- Ride height

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648 Wright, *Formula 1 Technology*. Page 170
649 Ibid. Pages 173-174

- Yaw rate using silicon devices but, "Greater precision will come with fiber-optic laser gyros."[650]
- Car position and attitude using Differential Global Positioning Systems (DGPS)
- Tire pressures
- High-speed video

These were all part of data capture needs, but fed another facet which was modeling, as inferred above, most likely using Monte Carlo simulation as it was based on probability.[651]

Writing for the website IT Peer Network on 19 June 2014, Mike Moshier stated that, "Formula 1 racing has been called a 'war of physics' because improving the engineering for a car based on aerodynamic principles is an ongoing process.".[652] F1 had indeed become a test of scientific methods and principles that required the most advanced computer processing capability outside of national initiatives. In time for the 2001 season, the McLaren team partnered with Sun Microsystems to be the first F1 team with a supercomputer.[653] For the 2007 season BMW-Sauber based in Switzerland installed what was then "the fastest supercomputer in industrial use in Europe" to simulate airflow using Computational Fluid Dynamics (CFD).[654] From that point forward, it was a matter of teams trying to keep up with the newest technologies for supercomputers in F1 with the most recent being the nascent but well-funded American Haas F1 team acquiring a Cray system in October 2018 all of which were housed at the headquarters facilities while portable high

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650 Ibid. Yaw was the side-to-side movement of a car. This use of laser gyro is further validated in an interview quoted from the 1980 in MacKenzie's *Knowing Machines* whereby, "Anyone who wants to play in the future has got to have a laser gyro, "MacKenzie. Page 93

651 ibid. Page 111

652 Mike Moshier, "Formula 1* Racing Teams Rely on High-Performance Computing " https://itpeernetwork.intel.com/formula-1-racing-teams-rely-on-high-performance-computing/#gs.M6UuedEe.

653 Staff, "Formula 1 in the Supercomputer Age," www.grandprix.com, http://www.grandprix.com/news/formula-1-in-the-supercomputer-age.html.

654 Tim Ferguson, "Supercomputer Is F1 Team's Secret Weapon," ZDNet.com, https://www.zdnet.com/article/supercomputer-is-f1-teams-secret-weapon/.

speed computers were brought to race tracks. In his elucidation on Robert Cray the inventor, sociologist Mackenzie informs how, “the supercomputer was now to be seen not as an artifact standing on its own but as a central part of a complex network.”[655] This facet became another node of the heterogeneous network that was M/S as additional elements and actors were added to the complexity that had to be negotiated by administrative and active participants.

6.4 END OF TOBACCO

The tension-filled socio-political issue of tobacco sponsorship for M/S came to a head during this period. It simply could not continue in light of the public decrying the hazards of tobacco and how that was in tension with active as well as enthusiast participants support of M/S. Drivers were no longer the risk-averse daredevils who jumped into a car with neither seatbelt nor reasonable helmet to determine who could go faster. They had shifted to become well-trained, health-conscious, and highly fit athletes. The use of tobacco had become anathema to the sport and those who enjoyed watching it.

Cigarette ads had been outlawed for decades but there was no legislative or regulatory shackle in the United States that prevented tobacco products from being seen at sporting venues, writ large M/S. The standard retort was that tobacco companies were not devising television ads, they were simply sponsoring racing teams during live events that happened to be televised. It is unclear how this regulatory oversight came to be without resorting to

[655] MacKenzie. Page 152. For an interesting perspective from the early years of computing intelligence and the question “Can machines think?” see, A.M. Turing, "Computing Machinery and Intelligence," in *The Mind's I: Fantasies and Reflections on Self and Soul*, ed. Douglas Hofstadter (New York: Bantam Books, 1982, 1950). And the response, Douglas Hofstadter, "The Turing Test: A Coffeehouse Conversation," ibid. (1982).

unsubstantiated speculation of corporate pressure within the halls of Congress but RJR had thirty full years of Value Time On Camera (VTOC) through NASCAR. But Bill France, Jr. had been facing headwinds of change for some time and while he was loyal to RJR for its support, it had become politically untenable for NASCAR to continue that relationship. On the 19th of June 2003, amid great fanfare, Bill France, Jr held court to announce a 10-year, multi-million dollar deal with the telephony provider Nextel Corporation. This also meant that tickers running at the bottom of sports television revealing news updates about NASCAR's top series changed from the abbreviation NWC to NNC.[656] As Tim Donahue, CEO of Nextel at the time explained, "Nextel catered to small and mid-sized businesses around the country, and NASCAR had a huge appeal to our customers."[657] What was astounding about tobacco, however, was that smokeless varieties apparently had not been specifically targeted in legislation thus could continue sponsoring teams until an FDA mandate in 2010 ending any and all mention or visibility of tobacco. Ergo, throughout this decade chewing tobacco and snuff purveyors sponsored drivers with impunity.

The end of tobacco advertising in F1 and WEC was much more complex as they were global entities thus each nation had its own laws and customs. While the EU had long been campaigning to rid M/S of tobacco sponsorship, there was a different sentiment in Brazil and parts of Asia where F1 had become an unassailable institution as it continued to grow. Tobacco use in these global regions was heavier than in Europe and that was a factor in deciding the growth of F1. When the legislative powers of both England and the EU attempted to clamp down on F1 just before the change-over to the 21st century, BE simply

[656] NWC was NASCAR Winston Cup, and the NNC stood NASCAR Nextel Cup
[657] Branham. Page 169

threatened to relocate F1, by default implying the entire MSV, out of England over its potential bias.[658] The tentacles of that political battle stretched into race cancellations as was described for Spa with teams caught between administrative participants still acquiescing to tobacco companies in that not all F1 races were in the EU and EU politicians demanding an end to tobacco visibility.

Here is where the dilemma went from bombast and effusive language to a real-world scenario. First, the total cost in 2005 for all ten F1 teams with two cars per team was a staggering equivalent of $2,808,480,000 as calculated by one of the most respected M/S journalists in the world, Alan Henry. [659] Further, McLaren Mercedes required twenty months of design time to field a car for the first race of the 2006 which required approximately the equivalent of $380-million not including the driver salaries.[660] This timeline was common for all F1 teams yet expenses varied and if funding had been cut half-way through car development it would have caused irreparable harm to F1. Fortunately, almost every team realized what might lay ahead in the future and had time to secure alternate sponsors so that when the FIA announced its ban on tobacco advertising effective the 2006 season most teams were ready.

6.5 NEW SPACES, NEW METHODS

During this decade in NASCAR, there were only two new tracks with the addition of Kansas City in 2001 and Chicago in 2002. However, in F1 the global vision that BE had decades earlier was becoming much more clear with new spaces in Bahrain (2004),

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[658] Henry, *The Powerbrokers: The Battle for F1's Billions*. Page 50
[659] *The Grand Prix Companion*. Page 225
[660] Ibid. Pages 191-201

Singapore (2008), Abu Dhabi (2009), and Circuit of the Americas (COTA) in Austin, Texas (2010) which continue hosting F1 to the present day. Others at Shanghai (2004), Istanbul (2005), Korea (2010), and India (2011) were each able to host two to four races but, as in the previous chapter, the combination of lack of established M/S culture and lack of government fiscal support were insurmountable obstacles to overcome. There was also a burgeoning sense in the M/S media of "Tilke fatigue". Hermann Tilke is a German engineer who designs racing circuits and many of the same features were replicated in similar style of angularity and circular patterns so while they were not the same track, there were enough similarities to be noticeable.

Unlike most newly developed racetracks, the erection of Bahrain International Circuit (BIC) was the result of great care and attention to important cultural and environmental aspects. For example, one observer noticed that, "The Formula 1 Grandstand reconstructs the traditional wind tower as a visual metaphor to connect with the past."[661] Sociocultural details were so ingrained into the design , planning, and construction they were able utilize, "modern materials [that were] moulded to achieve buildings with indigenous Bahraini characteristics."[662] The project was undertaken only after a full environmental impact assessment was completed resulting in the installation of a Teflon membrane over a 10,800 square meter area decreasing the "insolation" (incident solar radiation) which lowered interior-cooling load.[663] A highly engineered complex it was a setting of great meaning to the citizenry demonstrating, "a desire to seek a new place in the global world and it projects

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[661] Ranjith Dayaratne, "Landscapes of Nation: Constructing National Identity in the Deserts of Bahrain," *National Identities* 14, no. 3 (2012). Page 318

[662] N. Alnaser, Flanagan, R., et al., "Architectural, Construction, and Environmental Matters of Bahrain's International Formula 1 Circuit," *Building and Environment* 42 (2007). Page 1784

[663] Ibid. Page 1785

an image of a rising nation."[664] However, in 2011, and the next three years, this space was central to serious political strife with rioting in the streets and endangerment of the American military forces stationed nearby resulting in calls for cancelling the F1 race which went unheeded.

6.6 MONTE-CARLO, MONACO

Without having access to archival sources for both Monaco and Le Mans, research was constrained to available literature. Monaco and Monte Carlo are used interchangeably.

États-Unis) réservé aux carnivores. Cadre tendance, très prisé de la clientèle l

MONTE-CARLO Centre Mondain de la Principauté
(Monaco) – 15 507 hab. – Carte Michelin 341-F5 – Voir carte n°**42**-E2
Paris 947 km – Menton 9 km – Monaco 2 km – Nice 20 km

Hôtel de Paris ch, rest,
pl. du Casino – (00-377) 98 06 30 00 – www.hoteldeparismontecarlo.com Plan :
143 ch – 450/1335 € 450/1335 € – 39 suites – 43 €
Rest *Le Louis XV-Alain Ducasse*
Rest *Grill de l'Hôtel de Paris*
Rest *Côté Jardin* – voir les restaurants ci-après
Rest *Salle Empire* (00-377) 98 06 89 89 – Carte 110/190 € *(ouvert juil.- et fermé le midi)*
Aménagements somptueux, luxe sans fausse note, espace bien-être fabuleu plus prestigieux des palaces monégasques, l'un des plus beaux hôtels sur la d'Azur... une légende !

Hermitage ch,
square Beaumarchais – (00-377) 98 06 40 00 – www.montecarloresort.con Plan :
244 ch – 284/1250 € 284/1250 € – 34 suites – 41 €
Rest *Vistamar* – voir les restaurants ci-après
Rest *Limun Bar* (00-377) 98 06 98 48 – Carte 68/98 €
Derrière une foisonnante façade 1900, une coupole signée Eiffel, un délug mosaïques, moulures, pampilles... Confort extrême, à la pointe de l'élég contemporaine dans les deux ailes rénovées. Beaux équipements pour sém res. Petite restauration et salon de thé au Limun Bar.

Monte Carlo Bay Hotel and Resort
40 av. Princesse-Grace – (00-377) 98 06 02 00 – www.montecarlobay.com Plan :
334 ch – 370/1100 € 370/1100 € – 22 suites – 32 €
Rest *Le Blue Bay* – voir les restaurants ci-après
Rest *L'Orange Verte* (00-377) 98 06 03 60 – Menu 27 € (déj. en semaine)/37 € – Carte 44/75 €
Rest *Las Brisas* (00-377) 98 06 03 60 – Formule 27 € – Menu 37 € (semaine) – Carte 51/83 € *(ouvert de mai à sept. et fermé le soir*
Né en 2005, ce palace monégasque s'étend sur 4 ha gagnés sur la mer... Un vers en soi, avec une extraordinaire "piscine-lagon" (bassin à fond de sable), jardins méditerranéens, de superbes chambres contemporaines, plusieurs res rants et un casino !

1962

Fig. 6-10: 2014 *Michelin* France Guide: Monte Carlo. Personal photo of personal copy.

The Principality of Monaco lies at the intersection of the French Maritime Alps to the north, the French Riviera to the west, the Mediterranean Sea to the south, Italy to the east, and

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[664] Dayaratne. Page 319

has been ruled by the House of Grimaldi dating back to 1297. The city of Monte Carlo where the race is run is one of four *quartiers* that comprise Monaco. What became the world's most recognized casino opened in 1861 after Prince Charles III of Monaco approved a joint-stock company to undertake the project and which currently contributes less than five percent of annual state budget.[665] In 1866 he declared the district around it as Monte-Carlo. Long a destination for the world's richest and the curious, its relationship with M/S began as a rally in 1911 on public roads in the peripheral mountains ending in the city that continued uninterrupted except for wars to the current day.[666]

Winter tourism by the wealthy from the colder northern climes to the Côte d'Azur and the whole Riviera in general, began in the late nineteenth century thus forming a new basis for its economy. Prior to then it was a poor region reliant upon the land and the sea for its economy. Nice was the first city to upgrade its infrastructure as new hotels sprang up across the Riviera and while it never fell from grace as a destination, Monte Carlo grew in stature with its casino as, "Other Boulevards des Anglais developed along the Côte d'Azur, and car racing became the new modern attraction in the area."[667] That racing was because Antony Noghes, founder and president of the Automobile Club de Monaco (ACM), was able to select a route through the city and persuade those in power in 1928 that it would generate tourism revenue.[668] Though it was a refined atmosphere of the European elite,

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665 "Monte-Carlo," in *The New Encyclopaedia Britannica*, ed. Phillip Goetz (Chicago: Encyclopaedia Britannica, Inc., 1988). Page 279, 2b

666 In referring to this particular race space in any M/S literature, the terms "Monaco" and "Monte-Carlo" are used interchangeably.

667 Paolo Capuzzo, "Spectacles of Sociability: European Cities as Sites of Consumption," in *Urban Machinery: Inside Modern European Cities*, ed. M. Hård, Misa, T. (Cambridge: the MIT Press, 2008). Page 114

668 Hughes. Page 234. Figures vary but the current revenue of the F1 Grand Prix weekend to Monaco is in the hundreds of millions.

those sophisticated men, and some women, also were risk takers (gambling at the casino was a risk). The first race was run the following year and as it would happen, the Monegasques accepted the annual four-day disruption and the world welcomed another entry onto the social calendar.[669]

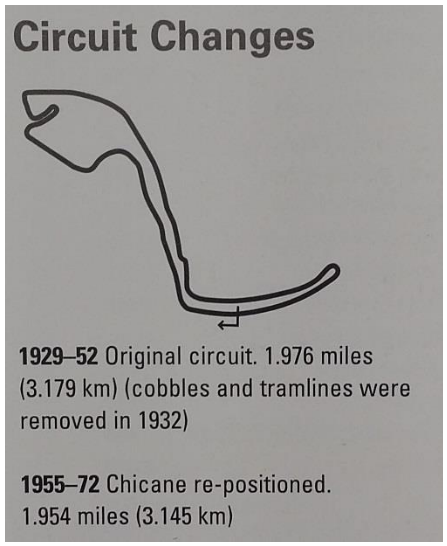

Fig. 6-11: Original race space of Monte Carlo. Higham, Page 119

With the exception of two small-scale modifications, it was essentially unchanged at just over three kilometers (1.9 miles) in length until 1973 yet it continued growing in popularity every year as more people attended than had in the previous year.[670] It was no longer the rich and famous but also the average enthusiast participants who had recently acquired the time and funds to make that vacation trip to that special destination in M/S. The means of travel to Monaco had changed as well, much to the disappointment of Louis Stanley.[671] A proud member of the *ancien regime* of stalwart traditionalists, he was simultaneous rebellious when it came to safety in racing thus fought tooth-and-nail on drivers' behalf.

[669] Hamilton. Page 24
[670] Higham. Page 119
[671] Lord Stanley was very prominent in fight for safety measures during the early years of F1.

He eloquently takes the reader through an entire paragraph reminiscing about previous journeys from England to Monaco which began at “Victoria Station with the bright blue coaches of the *Train Bleu* waiting at the platform” stopping in Paris for dinner at a restaurant then returning for the sleeping car ride until getting his, “first glimpse of the Mediterranean blue.”[672] In 1958 BE went to Monaco for the first time in an effort to qualify as a driver and although he failed that, “he was intoxicated by the atmosphere”[673]

An exceptionally difficult track to navigate, it also requires a special set-up from any other location for maximum downforce, soft suspension to absorb the street bumps, and a soft tire compound for improved grip. It was much easier during this period to model historical data and more accurately make wing adjustments or changes to carbon fiber materials through the use of algorithms and supercomputers than it was in earlier decades when the data was reliant upon handwritten notes or an individual’s memory be they driver or engineer or mechanic. That said, driver skill and ability were paramount. The four-time F1 champion Alain Prost (France) relates that, “If you are impulsive at Monaco, you are likely to end up in the barrier.”[674] Former F1 champion Nigel Mansell refers to the circuit as, “It’s challenging, it’s very daunting, and I find it fascinating.”[675] There was very little room for overtaking and Mansell never won here in his nine attempts. Indeed, it was precisely because of the excitement of great racing and the heady atmosphere that prompted grand

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672 Stanley. Page 54
673 Bower. Page 30
674 Henry, *Grand Prix Circuits: A Tour of Formula 1 Circuits from Starting Grid to Chequred Flag*. Page 35
675 Mansell. Page 38

social gatherings plus important business negotiations were initiated, sometimes tabled, but many times successfully completed.

Fig. 6-12: First new chicane from the *piscine* addition in 1975. Photo courtesy IMRRC. 08A1_Barnett_Collection_1975_Monaco_GP_IMRRC_003

In 1973 the first significant modification materialized when a bit of land was reclaimed from the harbor so that a city pool could be constructed. This diverted the race space outward with two new immediate chicanes as another test to driver skill and was eponymously named *Piscine*. Then, in 1986, a chicane was added at the bottom of the tunnel exit in order to slow cars and, as a result, the total distance from the alterations became 3.36 kilometers. Finally, the last noteworthy structural change was the 2005 raising of a permanent paddock edifice with a *parc fermé* as required by the new FIA regulations. It had to accommodate the new computer systems for each team thus power, cooling systems, space, connectivity, ad inf. When the three top finishers completed their cool-down lap there was no victory circle or lane for them walk to. Instead it was the royal viewing box at the start/finish line where the ceremonies of national anthems for driver and team were played, trophies handed out by national dignitaries, and finally champagne was sprayed (after the royal family had vacated the area.)

Monte-Carlo is the slowest track in F1 bar none with an average lap speed below 70-mph but it would be imprudent to conclude that it was without danger as there were four major shunts and they occurred within meters of one another over a period of forty years at the fastest segment of the entire course.[676] In 1955, F1 champion Alberto Ascari (Italy) had a brake lock-up which thrust him through the hay bales delineating the track's edge and launching him into the Mediterranean. He quickly came to surface uninjured and was pulled aboard a pre-positioned safety boat. Then, in 1965, the Australian driver Paul Hawkins duplicated that feat from the same location fortunately with the same outcome. Two years later the scenario was gruesome at that same place as the car Italian driver Lorenzo Bandini was piloting struck a kerb which hurled his vehicle to the opposite side of the track flipping it over and bursting into flames with him still in the car but not moving. With inadequate fire-fighting equipment for the marshals, it took help from spectators to remove him from the car, but to avail as he would perish.[677] In that era the racing continued to its normal conclusion despite the incidents. Finally, the German Karl Wendlinger crashed in 1994 after exiting the tunnel mere yards from the previous three wrecks and went into a coma at the hospital from which he did recover. There have quite naturally been many other conflagrations between drivers but none more serious than those profiled here.

There are features unique to the Monaco Grand Prix circuit that while anachronistic, make the racing here so interesting. To begin, it is the continuity of 100 years of racing on the city streets as they existed at the time of the competition which meant securing heavy man-hole covers and no special treatment of the surface so tires would lose grip on directional

[676] Higham. Page 118
[677] Stanley. Page 126

arrows and lane markers. Throughout M/S literature the sentiment has been that to propose a new course such as this would be doomed from the outset for safety, operational, and logistical reasons yet there was still an air of good fortune that participants have been able to observe and support this activity at this space and it has succeeded over time. Second is the hairpin turn that has been named many names but comes after Mirabeau and before the tunnel whereby teams had to build special steering racks just to navigate this one turn. It has always been the slowest section in F1 and required a deft touch as a misjudged angle of approach required putting the car in reverse to the detriment and displeasure of drivers immediately behind. This was another exhibition of a tacit, informed skill as cars in this phase were physically larger than decades earlier. This knowledge was learned through the use of software modeling the course in conjunction with the team's own data packet based on historical input enabling the driver to "learn" the circuit from a studio in the MSV and exactly how to navigate, when and where to begin a turning motion in order to successfully pass through the Hairpin. The same can be said the rest of the track but negotiating a space at a very slow speed runs counterintuitive for a racecar driver.

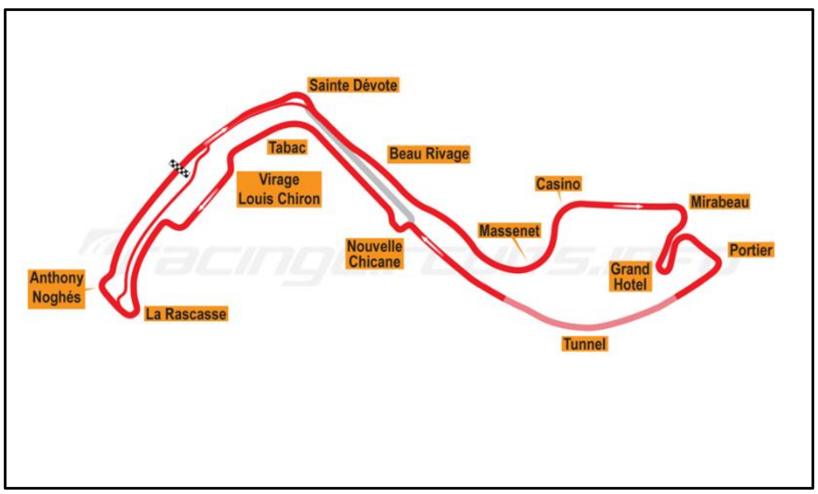

Fig. 6-13: Current configuration of Monaco circuit. This map is laying on its right side in comparison to previous map of original course. Courtesy RacingCircuits.info

The final unique feature is the tunnel. Not found at any other venue in the F1 network, the tunnel is several hundred meters in length and extracts incomparable reactions from F1 drivers.[678] Cut through solid rock, it has had several names affiliated with it and subject to the continuous change of ownership of the hotel that was built atop the road. It is a particular challenge adjusting to this complication especially in late May when the climate usually displays full sunshine. Typically drivers had tinted visors which created a distraction entering the darkened as their eyes recalibrated from bright to dark even with a lighting system in the tunnel. Next, since the tunnel was curved drivers had to quickly re-assess their bearings until they could see the light of the exit all the while accelerating through the darkened space. Concomitantly, they had to be aware of the change in the car's handling because, "You also go from fresh air to an area where the air is still and that can affect the aerodynamics of the car. You can lose 20 to 30 per cent (sic) of download."[679] Upon exiting the tunnel back into the bright sunlight at full song the street descended sharply that required another deft but heavy touch on the brake for the impending chicane because no driver wanted to be the fifth major *caramboulage* like the four mentioned above.

The most remarkable aspect of the Monaco Grand Prix was the method of preparation in converting the quaint city into a technological metropole for four days, and then disassembly of so many barriers and grandstands. With the exception of red and white kerbing throughout the city, there were no identifiable artifacts to indicate this was one of the crown jewels in M/S. Overall preparation began six to seven weeks in advance with

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678 Map of current Monaco circuit accessed from http://www.racingcircuits.info/europe/monaco/monte-carlo/#.XGoYr8JYbIU

679 Mansell. Page 42

approximately six private companies involved from the beginning to determine what items were necessary and from where they would be retrieved. There was insufficient storage in the Principality thus capacity was diverted to Nice and locations near the Italian border as it was necessary to spread the inventory across the region. To enable this herculean effort according to Michel Ferry of the ACM, required 21 kilometers of Armco barriers, about one kilometer of plasticized and formable Tecpro barrier blocks, 20,000 square meters of wire netting, 1.5 tons of grandstand material, 3,000 protective tires, 800 fire extinguishers, and nine cranes to lift disabled cars away from racing line, and approximately 250 people to build this.[680] The physical act of creating this annual event in just three weeks after three weeks of planning occurred while streets were still in use until the Thursday before the race and tear-down began at 6:00pm following the race as barriers re-opened to regular traffic. The greatest challenge was building the race control tower since it housed all of the technology to properly manage a 21st-century race. In a way this element of racing at Monaco, could be considered in the same vein as contributions in the edited book *Urban Machinery* by Hård and Misa. In one sense the "old" Monte-Carlo was modernized annually with a raucous high-tech intrusion onto the civil space and in another it was without question a site of consumption that was made uniquely "Car Friendly" for a special type of car."[681]

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[680] Staff, "Monte Carlo's Miracle - Making Monaco Race Ready," Formula1.com.

[681] M. Hård, Misa, T., ed. *Urban Machinery: Inside Modern European Cities* (Cambridge: The MIT Press, 2008). For modernizing a city see, "Modernizing European Cities: Technological Uniformity and Cultural Distinction," in *Urban Machinery: Inside Modern European Spaces*, ed. M. Hård, Misa, T. (Cambridge: The MIT Press, 2008). Pages 1-22 For consumption see, Capuzzo. Pages 99-120. For car friendly see, Per Lundin, "Mediators of Modernity: Planning Experts and the Making of the "Car-Friendly" City in Europe," in *Urban Machinery: Inside Modern European Spaces*, ed. M. Hård, Misa, T. (Cambridge: The MIT Press, 2008). Pages 281-298

6.7 LE MANS

Situated in northwestern France, the city of Le Mans was named by a Gallic tribe, Cenomani, fortified by the Roman Empire, and it is the capital of the Sarthe department in the Pays de la Loire region.[682] Evangelized in the Third Century by St. Julian, the city is home to a large cathedral and church from the late Middle Ages with numerous Renaissance era homes. Industrial production began in the mid-1800s expanding in the 20th Century to heavy machinery and transportation related parts and more recently moving into information services.

The first Grand Prix of any kind was conducted in this area in 1906 and while other competitions ensued under the umbrella of Automobile Club de l'Ouest (ACO), the first 24-hour event officially transpired on May 26-27, 1923. With financial backing from the French subsidiary of Rudge Whitworth, a wheels company, the secretary of the ACO, Georges Durand was presented with an opportunity. He realized that conventional racing was centered on speed alone but it would be more interesting to test endurance and reliability over a longer period like 24 hours to which the ACO President Gustave Singher and local officials concurred. Initially 17.26 kilometers it encroached into the Pontlieue suburb just south of town center, the layout moved further south in 1929 to avoid the suburbs. Three years later the configuration was shaped by the purchase of land near the paddocks that became Tetre Rouge to the 13.48 kilometer figure that is generally similar to the current day. During those early years of competition it was the British contingent that achieved the most success as several rich enthusiasts acquired or were hired by the

[682] "Le Mans," in *The Encyclopaedia Brittanica*, ed. Phillip Goetz (Chicago: Encyclopaedia Brtiannica, Inc., 1988). Page 788, 2b

Bentley Car Company, the strongest car of the era.[683] They became known as the Bentley Boys, but following the Depression no one could afford these cars for racing.[684]

The racing was on hold during and immediately after World War II as the Le Mans space had been usurped by the German Luftwaffe as an airfield and severely damaged because of it.[685] A very key point must be re-iterated here about WEC type races. There were multiple categories from exotic prototypes, to highly modified sports cars, to moderately enhanced sports cars It would not be until 1949 that the *24 Heures du Mans* could resume mostly with a variety of race-worthy vehicles so the ACO broadened the homologation

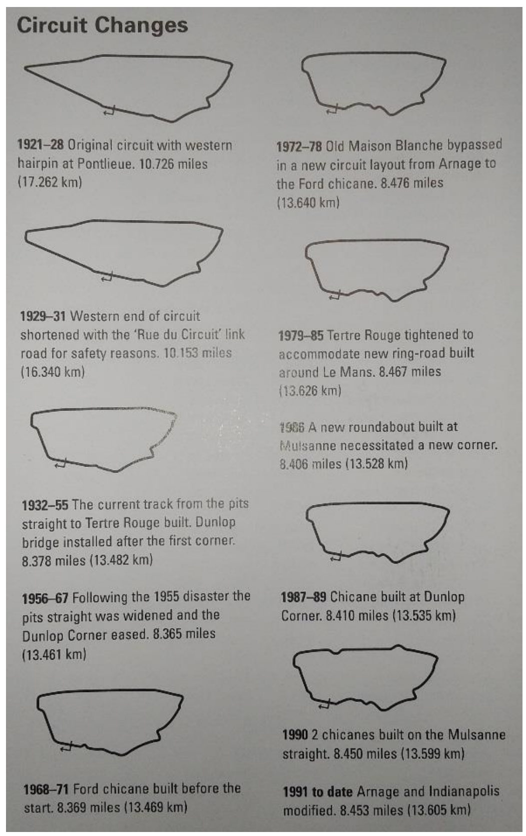

Fig. 6-14: Le Mans circuit maps over time. All modifications made to the Le Mans race space from its inception. Courtesy Higham, page 93

683 Rendall. Page 101.
684 Although several are still running in private collections.
685 Rendall. Page 164.

rules to allow low-production rate prototype cars to compete where previously the models had to be commercially available – a very similar thought process as Bill France required in early years of NASCAR.. A sense of normalcy had returned to M/S following the global conflagration such that interest in, and attendance at, LeMans grew annually.

Then, in 1955, the unthinkable actually happened when a car somersaulted and disintegrated into the front stretch grandstands, the most populous location anywhere on the circuit. As previously stated, this shocking event has been acknowledged in this narrative and explained by many other authors thus will not be detailed here. What is important for this document's contention is to understand that swift actions were taken by many regulatory bodies in different countries. Furthermore, participants committed to continuing their involvement with some active and administrative participants (John Fitch, Jackie Stewart, Louis Stanley) accepting a more responsible vision of improving conditions and rules with the support of enthusiast participants. Despite the work of those people, it would take another fifteen years for the ACO to erect a physical barrier separating the working area of pit road (refueling, tire changes, etc.) from the full speed racing line.

Fig. 6-15: The prototypical running start at LeMans with drivers galloping to their cars in 1959. Courtesy IMRRC. Associated Press photo (AP059)

There are two anomalies wrapped in the Le Mans framework from this epoch. The first resides with F1 including the smaller interior Bugatti course on the 1969 schedule. Poorly attended and anemic as an F1 event, the series never returned.[686] The other was the termination of a start that began with drivers running from the opposite side of the track then jumping, starting the car and eventually attaching their seatbelts. It became too dangerous for a number of reasons and was banned as of 1970. In terms of major modifications to the physical space of Circuit de la Sarthe, the Armco barriers keeping cars on the track were installed in the early 1970s. For a very large race space like LeMans this was significant as *in tempus* speeds attained were becoming frightful. Multiple smaller scale updates were made to widen the track and minimize close-quarter racing as well as to slow cars with chicanes but the priority was more on infrastructure as the condition for competing had outgrown both place and space.[687] The advent of computers required extra wiring, the innovation of four-post air-jacks required pressurized air delivery systems, and

[686] Hamilton. Page 120
[687] Higham. Page 93

the environmental challenge to collect all waste liquids meant reconfiguration of the garage areas.

In an undated timeline document from an ACO website several years ago there is an entry for "Circuit No. 9 13.535 km" which states, "In 1988, work is carried out on the straight line of the Hunaudières. The Ponts et Chaussées (the Highways Department) uses laser in order to obtain a perfect flatness of the track. This results in a marked improvement in the top speeds."[688] The intentions might have been good but the consequence was that velocities were too high as that year French driver Roger Dorchy attained a record speed of 407-kmh (252-mph) on the six kilometer long Mulsanne Straight as it was commonly known but more correctly named as "Rue des Hunaudières" This incentivized the FIA to mandate in 1990 that no straightaway could exceed two kilometers in length which forced the ACO to add two chicanes on that stretch. The speeds which cars in F1 and WEC of the 80s and 90s were capable of reaching was creating a problem for the FIA. Strangling the racing element by reducing engine power with draconian measures would have alienated the escalating enthusiast demographics so the result was to add chicanes at strategic points instead. This maintained the competitiveness of the race flow while also attenuating high speeds to more navigable levels.

With ever increasing capacity for capturing and transmitting data as outlined above, the ACO renovated the paddock area as by then magnetic interference, connectivity, and data packets were keywords in the language of managing a WEC race team with the ACO being required to provide that infrastructure. To re-iterate, Le Mans was different from any other

[688] ACO document likely from 2010 with details of the fourteen circuit changes. The translation is distinctly conversational as transliteration errors are copious.

circuit profiled here in that for the re-named NNC in America there were 43 cars needing service on pit road using temporary and open-air spaces. In F1 there were only twenty cars that, as of 2005, used permanent garage facilities at all tracks. The WEC format, however, had 50-60 cars depending upon the entries each year so it was essential that the track could accommodate all entries with equal facilities. The core of racing at Le Mans had been transformed from hobbyist, factory driver, and playboy to a strand of professional drivers and engineers with expensive equipment generating calculated options that formerly were based on intuition. Why was racing at Le Mans still such a monumental affair?

The answer to this resides in different sentiments about M/S. For some it was the connection to history of M/S and the chance to be elevated among the few who had both skill and ability, in conjunction with, equipment to drive farther than their competitors. A little known rule unique to the 24-hour racing at Le Mans was that all cars must turn off the engine during a pit stop. Primarily for safety against fire or accidental engagement of the transmission, the other reason was that the race was a test of endurance thus all components must be tested which included the starter mechanism. This spectacle was not merely a test of all components, but of personnel as well. It was commonplace to see mechanics draped over their workbenches and crew members either slumped over in a corner or leaning against a stack of tires trying to catch some sleep during the race. It is important to realize that despite the mid-afternoon start time for the 24-hour race, the team had been awake since early morning with pre-race checklists.

For others, the race was a personal test of stamina by completing driving shifts smoothly and remaining in contention deep into the early morning hours. While testing the limits of control as a driver it also meant pushing beyond the competition. Finally, the automotive heritage was important as a driver that might have been piloting a vehicle on a dynastic ascendancy like the 1950s Jaguars, the Ferraris and Fords from the 60s and Porsche from the 1970s/80s. It was also the last vestige which harkened back to the open road course racing by situating the driver in a modern car approaching 300-kmh under controlled circumstances and mere days before or after be driving a personal vehicle or rental car on that same stretch as a public space with other drivers or around a farm tractor and trailer with the day's harvest.

In the first decade of the new millennium, the technology of turbo-diesel injection (TDI) launched Peugeot and Audi as brands on the cusp of advanced capabilities and their performance transferred to their street cars.[689] A feature that would spread across all categories for WEC contest participants.

6.8 CONCLUSION

As the decade opened a global sigh of relief was felt that the hysteria of Y2K, along with multi-billions of consulting expenses to prepare corporations for the conversion, was successfully resolved. The second year was diametrically opposite in sentiment with tragedies and another global reckoning from the 9/11 disaster. Yet as this era unfolded it became apparent that three particular themes, health, safety, and data, played out across multiple touchpoints in M/S.

Beginning with health, it had a duality in its manifestation. One path led to personal health with the declining consumption of tobacco products both individually and as members of

[689] Henry. Page 144

communities with increased emphasis and concern over second-hand smoke. The political optics were a conundrum for the many enthusiast participants as to how could they have continued to support M/S when it was sponsored by tobacco, especially for those who had quit smoking or using oral tobacco products. The other element of health concerned the health of the planet. The issues of carbon emissions, Green-House-Gases (GHG), and climate change became matters of political emphasis and the FIA needed to weigh-in with sincerity. The FIA Foundation and its motto, "Safe, Clean, Fair, Green" launched several initiatives world-wide while it authorized experimental rules to allow turbo-diesel competition at Le Mans which was cleaner, more efficient, and quieter than conventional ICE prototypes, plus the ban on F1 re-fueling.[690] NASCAR also reacted by converting to unleaded gasoline in 2007. Even more significant was the Michelin Green X Challenge in ALMS and later in IMSA to explore alternatives to the internal-combustion-engine. The dividend from this endeavor would be paid forward in the period after this phase.

The second theme to consider is associated with safety in the context of on-course speed. Pacey shares that, "talk about 'technological imperatives' may disguise a whole range of other impulses concerned with aesthetics, materials, and mobility. Especially significant is the impulse to master and manipulate elemental force."[691] In NASCAR this mastery resulted in incremental changes to internal engine components or configurations as well as fuel delivery systems and drive-trains in order to compete on a 400 to 600 mile event at constant top speed. In F1 and WEC the mastery and manipulation was over properly

[690] One of the initiatives at the forefront was actually launched after this phase with the "Decade of Action For Road Safety" in conjunction with the United Nations and the World Health Organization among others. The initial focus was on physical road structures and then operation of unsafe vehicles.
[691] Pacey. Page 86

forming the carbon fiber material for less weight and stability plus aerodynamics by refining shapes or sizes of wings and winglets. That mastery was indeed too successful for the physical limitations of existing race spaces. Consequently, administrative participants were forced to react with the simplest methods at hand which was adding chicanes at strategic points. The alternatives of re-construction or building new spaces were not feasible but there was concern about stagnating the competition. The actual experiences and research data bore out the intent of chicanes as means to reduce high-speed severe crashes.[692]

The issue of safety was prevalent in NASCAR as was resistance to change with fatal consequences. The death of multiple drivers including a seven-time champion brightly illuminated the greater problem of safety. The HANS device was available for the 2001 Daytona 500 but not mandated in deference to Dale Earnhardt and the legion of drivers who agreed with his perspective of individual choice over decree. After he was killed, the decision was no longer left to drivers but required. Barriers in F1 and WEC were constantly under review for better alternatives primarily regarding effectiveness and speed of recovery but did not face the same high-velocity, high-impact scenario as with NASCAR. The concrete ring around the American ovals had clearly demonstrated lethality and the recently developed SAFER barriers mitigated those impacts. Desperately needed, there was an imbalance of demand versus supply requiring a production ramp-up that would continue well into the late twenty-teens.

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[692] L. Leonard, Lim, A., et al., "Does Changing the Configuration of a Motor Racing Circuit Make It Safer?," *British Journal of Sports Medicine* 39 (2005).

This phase also witnessed the expansion of the heterogenous network with the evolution of the supercomputer, high-speed communication, and connectivity in F1. In the mid-1990s data was still captured manually on charts in NASCAR.[693] The notion of modeling was in its infancy in F1 and by adding sensors throughout the vehicle, data was systemically gathered yet computing power was inadequate for timely processing. By upgrading to supercomputers it also constituted a change in organization of work and the creation of new functions or positions on the team.[694] The teams also now had two command and

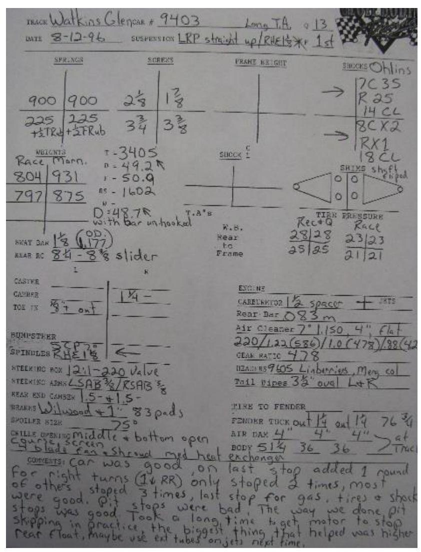

Fig. 6-16: Data sheet for set-up of Geoff Bodine NASCAR Winston Cup race at Watkins Glen, August 1996. Courtesy IMRRC.

control centers, one on-site at the race and one distant through the utilization of powerful communication systems. This illustrated Castells' commentary on information flows that, "The informational, global economy is organized around command and control centers

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[693] Set-up sheet for Geoff Bodine, Accession 99A77, Geoff Bodine, IMRRC, Watkins Glen, NY
[694] Pacey. Page 19. Pacey gives the example of the creation of factories in changing the organization of production work in England which is distilled here to a specific industry.

able to coordinate, innovate, and manage the intertwined activities of networks and firms."[695]

LeMans and Monte-Carlo are situated in this phase because they epitomized momentum very early in the life-cycle of iconic M/S circuits and continued virtually uninterrupted for a century with each year garnering more interest and spectators. Across the decades, it was at Le Mans where the constant notion of "reverse salients" in M/S was most evident as Rendall confirms, "There is a pattern to winning at Le Mans. A manufacturer makes a great effort and wins, sometimes several years in succession…challenge comes from another firm…beat[s] the previous winner…Then along comes another challenger."[696] And so it was in all top level series as one innovator finds success, most follow while some struggled to match a combination of new technological enhancement, coupled with aerodynamics, and handling or stability, and speed.

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[695] Castells, *The Rise of the Network Society*. Page 409
[696] Rendall. Page 184

CHAPTER VII: EPILOGUE AND CONCLUSION

7.1 EPILOGUE

In advance of my concluding remarks it would be careless to overlook a number of important developments which came to fruition in M/S after 2010, following the stated time period for this narrative. These are presented in ascending order of magnitude.

The first matter involved the stultifying decision by NASCAR to convert, effective the 2015 season, from carbureted engines for mixing air and fuel prior to the combustion stage to the more sophisticated and efficient fuel-injection method. The reason this was remarkable, and simultaneously inexplicable, is that the same conversion occurred in passenger cars in the mid-1990s. Why it took another 25 years for the highest level of stock motor racing has been marginalized for the most part but might be worthy of further examination.

With the departure of tobacco sponsorship in M/S at all levels new sponsors were necessary.[697] In NASCAR, the top tier "Cup" series was ensnared in a corporate merger as the Sprint telephony corporation acquired Nextel thus also encumbering Sprint with Nextel's financial obligations however that agreement was actually extended until 2017. Recognizing that the association had become stale – and Sprint had lost market share – the newest sponsor was quite appropriate for M/S with the Monster Energy NASCAR Cup (MENC) beginning with the 2018 season. In NASCAR's second division, corporate

[697] This was partly true until it was discovered recently that Marlboro was still sponsoring Ferrari through Mission Winnow for E-cigarettes which remains a developing story.

changes mirrored the Cup series as the Busch (beer) brand was replaced in 2007 by the Nationwide insurance company until 2014 when Comcast's Xfinity brand became the title sponsor. The two major 24-hour WEC contests at Daytona and LeMans retained the Rolex watch company as a continuing, decades-old sponsor. In F1, the series did not have a title sponsor or individually sponsored events until a few in 2018, but for 2019 each race has a sponsorship package. Why did this change happen in F1?

For decades Bernie Ecclestone (BE) had wielded ironclad power and control over F1 through innumerable slight-of-pen and slight-of-hand maneuvers plus flat-out Machiavellian tricks which included safe-haven, offshore banking accounts. In 2017, BE was in his 80s when the American media giant Liberty Media acquired Formula One Management and all of its tendrils for more than USD $4-billion. What this meant for F1 was literally game-changing. As we learned in an earlier chapter, BE's penchant for cleanliness, austerity, and appearance extended to the paddock area and his forbidding non-actives from mingling with the active participants or around the cars which he lately relented upon for a 30-minute pre-race session – at a very steep additional fee. Further he had no appreciation for the "fan experience" beyond their purchase of tickets. This unfulfilled aspect of being an enthusiast did not go unnoticed by some of the active participants. In 2003 several suppliers in the MSV went on record during interviews about the matter. The consensus was a lament in F1 that, "people cannot enjoy the competition as much as they should."[698] Building on that sentiment, the interviewees all turned toward NASCAR as the better model in that F1 needed to, "satisfy spectators, and allow them to

[698] The very successful chassis builder Gian Paolo Dallara, Henry. Page 139

get closer to, and more involved in, the action."[699] For one interviewee, these same authors summed up his comment succinctly with, "For David Richards, it is the consumer of automotive products that is top of the agenda in his motorsport business."[700] With Liberty Media that all changed and there has been a spate of enthusiast-oriented initiatives in F1.

At no point in F1 history, in fact in M/S history, had there been a complete manual or guide written as to how a given F1 circuit was to prepare for, or respond to, medical crises that derived from high-speed automotive incidents. That is until 2011 when the FIA published *Medicine In Motorsports*. That 260-page tome was Dr. Sid's crowning accomplishment and was compiled by numerous medical experts and racetrack Chief Medical Officers (CMO) counseling on all issues from driver physiology to operational requirements at an M/S circuit.[701]

Technology transfer could be considered by some as a polymorphic topic with a variety of biases and meanings. In this setting it is about combining the application of technologies and techniques in both M/S and non-M/S activities for a novel outcome by combining continuous glucose monitoring with highly specialized and focused electronics and sophisticated technology to communicate those readings at more than 200-mph. Under normal professional working conditions, diabetes Type-I was a debilitating medical condition requiring both machine monitoring and, when feasible, human observation as a back-up. The latter was essential in the event the former was not attainable. Having Type-I diabetes in the workplace was one thing, having it in M/S was confoundingly and

[699] Ibid
[700] Ibid. Page 140 Richards is founder and Chairman of Prodrive, one of the world's largest specialist M/S companies
[701] Hartstein.

exponentially different. Charlie Kimball was a promising open-wheel racer in the United States until 2007 when he was diagnosed with Type-I diabetes but as a protégé of the powerful and championship winning Chip Ganassi Motorsports, several processes were empowered. The open-wheel series if Indy Racing League (IRL) is not central to this document but the technology devised to enable this driver's competitive skills is germane. In IRL, competitions take place on ovals, temporary city circuits, and road courses, thus a driver encounters lateral, longitudinal, and compressive G-forces ranging from three to six times bodyweight per turn multiplied by four to twelve turns per lap with between seventy to hundreds of laps plus continuous vibrations from the uneven surface.[702] In this cauldron of seemingly oppositional science, the ability to a) monitor glucose levels, and b) instantly deliver appropriate dosages of insulin while steering and changing gears at multiple G's was astounding. The technology to overcome all of the factors has enabled Kimball to remain competitive and also remains a closely guarded secret. This type of technology has recently been extended to NASCAR truck series driver Ryan Reed and to second-generation open-wheel driver Conor Daly. Even more amazingly, the NASCAR truck series was able to accommodate a "little person" in Rico Abreu from Louisiana at not even four feet tall. In the high-velocity and dangerous sport of American oval racing these were major departures from the norm epitomizing Castells' contribution to the conversation about technological convergence where he states, "Technological convergence increasingly extends to growing interdependence between the biological and micro-electronics revolutions, both materially and methodologically."[703]

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[702] With more turns there are less laps and vice-versa.
[703] Castells, *The Rise of the Network Society*. Page 72

The final two most important technologies that appeared in M/S after 2010 were both examples of Edgerton's Eighth Eclectic Thesis: "Invention and innovation rarely lead to use, but use often leads to invention and innovation."[704] The first is Regenerative Braking (RB) and a continuation of the evolutionary technology saga. We learned in chapter five about forays into stored energy in M/S that were halted by technical problems. However, in that same timeframe of the mid-to-late 1990s the Toyota Prius was launched proving that the technology worked in passenger cars (as it does today). When Peter Wright's book *Formula 1 Technology* was published in 2001 he acknowledged the "Patriot" and "Sparky" efforts but lamented that in all of the teams' agreement with FIA to ban the stored energy movement, "The opportunity to make a real contribution to the development of lightweight efficient hardware and control strategies for hybrid road cars has been lost.[705] Conversely, in 2008 testing on Kinetic Energy Recovery System (KERS) began with only four teams experimenting in 2009 as one of the problems with the system was not being fully discharged thus accidentally and severely shocking the first attending crew member to touch the car.[706] With improvements the technology has since been widely adopted and all twenty F1 cars are now fully hybrid, most WEC categories are hybrid, as is the IRL. Hybridity for NASCAR is pointless because that series is only about constant top speed.

The second new arrival was the creation by the FIA of the Formula E series, an all-electric series launched in September 2014. It has been well-documented that electric cars were produced and almost flourishing about the same time Karl Benz built his first car using a

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704 David Edgerton, "From Innovation to Use: Ten Eclectic These on the Historiography of Technology," *History and Technology* 16 (1999). Pages 123-124

705 Wright, *Formula 1 Technology*. Page 211 See also, Henry. *Motorsport Going Global.* Page 145

706 Under braking, kinetic energy was stored pending a release mechanism such as depletion through acceleration or an energy discharge button making it safe for a crew member to touch the vehicle.

four-stroke internal combustion engine (ICE) in the latter half of the 19th century.[707] However, in a display of "soft-determinism", users fastened on to the ICE more than either electric or steam powered vehicles during those foundational years resulting in the ICE as the preferred path forward during the 20th century.[708] Interest and research into electric cars resumed in the latter half of the century initially resulting in the Toyota Prius and later in the next century the Chevy Volt, among others.[709] The Formula E series is contested by factory teams and independent team owners in the heart of major metropoles across the globe because while their appearance is similar to F1 cars they are not as fast or as dangerous as F1 and they have much smaller entourages without requiring all of the accoutrements to support them as does F1. Initially the battery capacity necessitated each team to have two cars and the rules required the driver to physically exchange cars at the mid-point but that technical deficiency has been overcome and they now complete the entire race on one battery. As a branch of the greater M/S community and having just completed its fifth year, it has been very well received and is growing in popularity with global media coverage on race-day.

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[707] Gijs Mom, *The Electric Vehicle : Technology and Expectations in the Automobile Age* (Baltimore: Johns Hopkins University Press, 2004). See also, David Kirsch, *The Elecric Vehicle and the Burden of History* (New Brunswick: Rutgers University Press, 2000).

[708] Nye, *Technology Matters: Questions to Live With*. Page 55

[709] Robert U. Ayres, Richard P. McKenna, and Resources for the Future., *Alternatives to the Internal Combustion Engine; Impacts on Environmental Quality* (Baltimore,: Published for Resources for the Future by the Johns Hopkins University Press, 1972); A.F. Burke, Miersch, R., "Development of a Full-Size Hybrid (Electric/Ice) Passenger Car," in *Electric Vehicle Development Group - Fourth International Conference* (London: Peter Peregrinus, 1981); A. Nagasaka, Nada, M., Hamada, H., Hiramatsu, S., Kikuchi, Y., "Development of the Hybrid/Battery Ecu for the Toyota Hybrid System (981122)," *SAE Special Publications* Technology for Electric and Hybrid Vehicles, no. SP-1331 (1998); R. Kasama, Naito, S., Katada, H., Shibata, T, "The Efficiency Improvement of Electric Vehicles by Regenerative Braking," ibid., no. Paper # 780291 (1978); "Electric Cars: They're Cleaner But...", *Society for Science & the Public* 91, no. 10 (1967); Daniel Sperling, "Gearing up for Electric Cars," *Issues in Science and Technology* 11, no. 2 (1994); "Italian Designs for Electric Cars," *Engineering* 204, no. 5300 (1967); J Watson, Lee, G.A., "Traffic Compatible Hybrid Electric Vehicle," in *Electric Vehicle Development Group - Fourth International Conference* (London: Peter Peregrinus, Ltd., 1981); Phil Taylor, "When an Electric Car Dies, What Will Happen to the Battery?," *Scientific American*, 14 September 2009.

7.2 CONCLUSION

The re-development of postwar Europe during the years 1950 to early 1960s, enabled a period known as the *Wirtschaftswunder* in Germany and *Les Trente Glorieuses* in France. Although not always idyllic, it was a time of incredible growth and change. In M/S innovators like John Cooper broke paradigms in production of F1 chassis as entrepreneurs like Bill France, Sr. and Cameron Argetsinger conceived new race spaces and organizations. During the early 1960s to early 1980s, enthusiasts were transferring from individuals enjoying a sport to becoming a participant community sharing on a much broader scale. They had both time and money to actively consume goods, products, and services on scale never before encountered and this habit would be transferred to second and third generation M/S enthusiasts based on film footage over the decades. Further, M/S experienced massive transfers of locus and power in Europe with American regional centers transferring to consolidation in Charlotte, NC. From the early 1980s to the early 2000s, growth was apparent and critical problems were being solved in M/S. This growth was physical, demographic, financial, in popularity, and across key knowledge points among active participants. As the millennium changed to the early 2000s ending in 2010, there was considerable momentum carried over from the 1990s. The impetus spread to faster responses for better safety (after a major tragedy), greater involvement in environmental issues, and finding alternatives to offset the loss of tobacco funding.

With the complexity of multiple actors performing similar technical functions at the same time in different places, it would be useful to consider Andrew Pickering's *The Mangle of Practice* as a lens through which to view events. Starting with culture, M/S participants of all types developed their own culture or society with particular behaviors and language. He takes, "'culture' in a broad sense, to denote the 'made things' of science, in which I include skills and social relations, machines and instruments, as well as scientific facts and theories."[710] Among the unique behaviors for active participants was their interaction with tools and machines in the application of scientific principles in order to create a complex racecar which travelled at very high speeds. For some enthusiasts it was selecting items from toolboxes to work on their car while for others it was their profession as journalists composing words on a machine for publication to those home-mechanics of how engineers applied their knowledge. For active participants I would also point out his example of "what matters in metal cutting is a human-machine couple – the lathe and its skilled operator come together as a single unit of machinic capture."[711] The crew members' unique skills to know when a fastener is tight enough without using a torque-wrench or to feel that a component has been shaped properly, or a driver feeling something wrong in the steering linkage. Then there was getting to the race. Participants got into their vehicles (personal cars and car-hauler trucks) and piloted them over road networks in all forms of weather following the topography that may have simply been paved over with asphalt or built into hillsides and tunnels. Enroute they would interact with other members of the racing community easily identified by their conversations at restaurants and hotels. In passing from one period to the next there were, "open-ended transformations of science and society in terms of the temporally emergent making and breaking of cultural alignments and associations with the worlds of production and consumption, transformations understood as having no determinate destination in advance of practice."[712] The "scientification" of

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[710] Pickering. Page 3
[711] ibid. Page 158
[712] ibid. Page 232

car design transformed mechanics into engineers and the technification of M/S transformed teams yet again while also having modified the enthusiasts who consumed the sport.

In 1950 the FIA had just formed and there were only a few F1 races during the year as drivers were free to, and did, drive other cars in other types of M/S. It was the second year for NASCAR to have a schedule and virtually all of those racetracks had a dirt surface (Darlington had just opened). The industry of organized M/S was in its infancy. In the beginning, F1 consisted of factory (manufacturer) car teams which enabled certain drivers to pilot open-wheel cars faster than their competitors while sports cars, endurance (WEC), and American stock cars were mostly hobbyists and enthusiasts who drove and worked on their cars. As innovators made F1 and WEC more accessible, some enthusiasts converted into active participants challenging the status quo. Closer to the tracks, Englishman John Cooper completely transformed road racing by creating a mid-engine chassis for a better center-of-gravity thus better handling on curvy spaces. His countryman Colin Chapman took the paradigm further by creating a monocoque chassis for a stiffer vehicle thus even better handling. When independent drivers (mostly from England) combined those two features with a robust Ford DFV V-8 engine they began changing the power structure of the ruling class of Italian roadster racecars from Alfa-Romeo, Lancia, Maserati, and even Ferrari.

Bill France had professionalized the sport by applying regulations to a previously unregulated activity and small teams formed with owner, driver, and mechanic. He began building his system by consolidating the southeast regional tracks under his leadership putting on professional looking events (his mandate was “No jalopies”) and as a result he was able to grow the sport’s popularity (though not without controversy). Cameron

Argetsinger convinced the community leaders in and around Watkins Glen, NY to host a European-style road race on the surrounding roads and through the center of the village. It was successful beyond his expectations but it was an inevitable tragedy that forced it out of town to its eventual home at a purpose built facility less than two miles from the center of Watkins Glen. Bernie Ecclestone began building a successful used luxury car empire perfecting a variety of skills that would enable him to build what would become the F1 network of technical systems.

Throughout the 1950s decade, with direct and indirect American funding and American's spending as tourists or while serving tours of duty in the military in Europe, a new quality of life emerged from the rubble. One that enabled consumption and mobility that relied on an ever-growing network of E-roads[713]. Most Europeans had to learn what it meant to be in a consumer-based society as more and more options were placed before them with stores, food, appliances, cars, just to name a few. Having narrow roads and city streets, plus a high tax rate based on engine size, they bought smaller cars as for many it was their first car and many drove those cars to see races often with a small camping trailer attached. Americans were already well-versed in consumerism and were more than ready to resume their consumption with gusto. The young men who had served in World War II and then Korea were especially interested in big, powerful cars so as to make a visual statement resulting ever more garish designs with massive tailfins and chrome. There was a migration toward a new phenomenon called "suburbia" and ownership of a single-family dwelling thus the beginning of a car-based society.

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[713] The term "E-roads" was the numbered trans-European highway system explored in previous chapters

From the early 1960s to the early 1980s, people had become familiar with their “time budgets” as Grübler explained it. They began traveling to races as roadway networks were formed, cultural networks were forged, and technical associations (like SEMA) were created. They had vacation time, a vehicle to take them, and the funds to pay for the excursion. Or they could stay home on vacation and work on their own car for customization or better efficiency, or both. As they travelled they had new tools in the form of AAA guides to hotels in America and Michelin Guides in Europe. Unfortunately, the year 1973 made that very difficult worldwide with the gas crisis as long lines formed as allotted amounts were rationed and when it had subsided, automobility was very different on either side of the Atlantic. In Europe life resumed somewhat like it had before the crisis in terms of driving but there were other major problems. In the United States it was completely different with new regulatory mandates on fuel mileage standards, 5-mph bumpers on front and back, catalytic converters mandated on all cars and so on. The automotive design profession had transferred from powerful and elegant to stodgy.

In M/S, the success of the independent drivers created a new network of suppliers in the region west of London (but not quite to Birmingham) that would come to be known as Motor Sport Valley (MSV). As the independents suddenly began defeating the powerful, front-engine cars from Italy (Germany had withdrawn from F1), Enzo Ferrari finally had to succumb to the new standard of mid-engine, monocoque chassis created by the dreaded “garagistas”. The success of the independents in F1 created a new network of suppliers with a broader influence from the British Lower-Midlands which resulted in the transfer of technological locus for M/S in general from Italy to England as those specialty manufacturers began providing open-wheel chassis’ for teams all around the world. Tiny

English villages became home to headquarters and workshops for the most sophisticated automobile constructors and part manufacturers on the planet. F1 saw the creation of the Formula One Constructors Association (FOCA) which was joined by Bernie Ecclestone (BE). The FOCA constituents were primarily British who needed some way to challenge the political power of the factory teams like Ferrari. What took place in England appeared in a mirror-like scenario around Charlotte, North Carolina with teams and suppliers building a M/S node that included other new businesses to support the existence of those new families with food, home wares, appliances etc. Places like Mooresville and Kanapolis in North Carolina became familiar names in the language of NASCAR. A heterogeneous global network was forming with its broad spectrum of actors and actants.

These were also the most dangerous times to have been a driver in M/S. For NASCAR, barriers were less of a problem than fire during a crash as several suffered that fate. The problem for Bill France was his intention to maintain a strictly stock visual of the cars so people could identify with the winning car if they had the same brand. However, he was left without options thus he required implementing safety modifications for cars in order to compete in NASCAR events. It was simpler for France because he had control over the sport and it was all in America. For F1 it was far from simple in that each racing node was in a different country thus different rules and attitudes toward safety.

As Bill France had consolidated power in NASCAR, so BE began his co-produced hegemony over FOCA, F1, and FIA with flurries of separate negotiations directly with circuits, logistics providers, and eventually with media entities for control of television rights. Thus he had managed to consolidate power in himself in such a way that FOCA, FIA, and race organizers either followed BE’s requirements and desires or suffered the consequences, whatever those might have been given the myriad of scenarios. As John Kenneth Galbraith states, “How truly powerful a leader is can be judged by how well he can persuade his followers to accept his solutions to their problems, his path to their goals.”[714] BE’s persuasion took many forms.

It would take until 1978 at Monza and the crash that killed Swedish driver Ronnie Peterson for any fundamental radical approach to safer conditions transpired. That fell under the auspices of BE’s newly appointed Surgical Director for F1, Dr. Sid Watkins who, with full support of BE set about immediately changing requirements for medical support in order to host an F1 race. As the leader and “owner” of F1, the power over F1 had transferred from the FIA to BE who had by this time become a “social macroactor”[715] and while there was resistance by some nodes like Silverstone in England, most accommodated his demands because F1 races were matters of national pride. This was also the period that saw the two most vaunted circuits, Spa, and the Nürburgring, removed from the F1 calendar as too big and too dangerous. The former returned but the latter could not overcome the deficiencies.

Additionally, this was the epoch that I refer to as the “scientification” of M/S as a result of the addition of tobacco sponsorship. The tobacco companies needed an outlet for their billion-dollar budgets whereas by sponsoring F1 teams with vast sums of money as moving bill-boards later known in marketing terms as Value Time On Camera (VTOC), the teams could, in turn, spend more on design and development. The goal, of course, was to win and, as explicated in earlier chapter, to compete for a win was an expensive proposition

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[714] Galbraith. Page 46
[715] Pickering. Pages 237-239

according to Colin Chapman as he compared racecars to airplanes when asked about expenses. F1 team engineers like Peter Wright, John Barnard, and Adrian Newey began to intentionally experiment with scientific principles such as fluid dynamics, aerodynamic downforce, Bernoulli principle, lift on wings, a fan-car, among other efforts. Prior to this change in designing a race car, it had been based on observation and notes after the fact but the new techniques were based on scientific methods and calculations in advance. Tobacco funds would also contribute to NASCAR at all levels enabling administrative participants to provide better venues for active and enthusiast participants. In NASCAR it was the R. J. Reynolds tobacco company based in the southeast who had $575-million[716] to spend on advertising since that was recently prohibited in any media form. Much of that went to naming the series Winston Cup, to driver's purses which varied according to the race and the year, and to infrastructure development across several levels of NASCAR.

The growing group of enthusiast actors were also becoming more aware of, and vocal about, race safety in M/S and, in parallel, safety in automobility that was vigorously legislated. Engineers applied their knowledge of scientific principles for the practical purpose of making their teams' cars go faster than other teams in order to win and generate revenue from those wins. As Vannevar Bush wrote, "The function of applied research is to provide such complete answers [to]… a large number of important practical problems."[717] The solution of those practical problems eventually made their way to regular passenger cars with ABS brakes, lightweight materials, steering-column mounted paddle-shifter transmissions, and carbon fiber. There was, furthermore, increasingly loud enthusiast vocal

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[716] Branham. Page 150
[717] Bush. Page 18

discontent about the lack of effort by M/S regarding the environment as multiple regulatory fronts were opened to attack environmental problems such as emissions. The fabric of a heterogeneous network was weaving into a pattern not yet fully distinguishable but becoming discernable with its system nodes (racetracks) and centers (Charlotte and the MSV).

Examining the period from the early 1980s to the early 2000s, brings the chronicle to the technification of M/S concomitant with its growth. BE's vision of growing the F1 systems beyond Europe with an eye to Asia was on its way to becoming reality, and "Big Bill's" vision of a cost-to-coast NASCAR was enacted by his son Bill France, Jr. as several new nodes were added in both series. The fall of the Iron Curtain facilitated travel by many from former communist countries to now attend racing competitions in-person anywhere, including the Hungaroring added before the dissolution of the Iron Curtain. With France controlling broadcast rights for NASCAR, and BE owning the television rights to F1, they were able to negotiate lucrative deals that would ensure maximum viewing coverage such that F1 had an estimated fifty-million people watching each race on television.[718]. Corporations were also becoming more open to sponsoring a race team as viewership had been increasing steadily thus more VTOC for their product or service.

As innovation enabled the miniaturization of electronics, so too did it penetrate into M/S. For drivers this was beneficial to the extent the Accident Data Recorders in use on airplanes were made small and light enough to be installed in racecars. They began providing actual data to help make conditions safer and develop designs or methods to build safer cars. But

[718] Henry. Ibid

as the engineers had the funds and could acquire or manufacture devices, they began adding a myriad of driver assist components in F1. These included ABS braking, traction control, acceleration assist to prevent spinning tires, automatic gearboxes, among others. It did not take long for any one of these to become banned during the period referred to as “Gizmo cars”. But there were other devices in the form of sensors which captured data and transmitted status back to the race engineers in the paddock. This became an additional element in the heterogenous network that was more evident as technological systems.

For the viewer at home, the technology of electronics was a benefit as well. By using GPS data, graphic packages, and powerful computers to process algorithms calculating live moving data, enthusiasts were supplied with a broader experience. Add to this the in-car camera for additional live video and the vicarious involvement was made more complete. Fortunately, the in-car camera was not “live” when Ayrton Senna was killed slamming into the concrete wall at Imola in Italy. During one of the worst weekends in decades for F1, two drivers were killed (including multi-year F1 champion Senna) and another almost died in separate single-car accidents resulting in a variety of inquisitions into how that could have happened. From that Senna crash new regulations mandated how to prevent components separating from the car.

That same viewing experience was enhanced for all top tier M/S series by the addition of the GPS-based graphics. Concomitant with the visual representation was the nascent social media which enabled the creation of socio-technical networks of enthusiasts to share their voices and social commentary on major issues like environmental concerns with respect to M/S and automobility which had been elevated to the forefront.

The final segment, from early 2000s to 2010, had a very dark and tragic beginning. In NASCAR, three drivers were killed within 18 months from basilar skull fractures when their cars obliquely slammed into concrete walls at about 150-mph and one of them was seven-time champion Dale Earnhardt, Sr. which was followed a few months later with the horrific events of 9/11. Barely into the second year of the decade and a pall had been cast to be further followed by the Great Recession in the latter years. So on many fronts a forgettable beginning to the decade.

This was the timeframe that witnessed the exit of tobacco from these racing series with NASCAR in 2003 and F1 in 2005.[719] Having been aware of the potential because of political maneuvers the F1 teams had been able to secure major sponsors but not with the same largesse as tobacco firms. Nonetheless, there was enough funding for teams to embark on shopping sprees to acquire supercomputers for their headquarters in order to monitor sensor data from cars during the race as well as to run modeling algorithms in designing and setting up cars for future races. The idea of expanding this network by live, high-speed communication from the car to the home base in England was astounding. McLaren was the first to do so thus changing how F1 teams operated and validating Castells point that, "The inclusion/exclusion in networks, and the architecture of relationships between networks, enacted by light-speed operating information technologies, configurate dominant processes and functions in our societies."[720] Another example of momentum was the attendance which for NASCAR events started at about

[719] This is where, for F1, the Maastricht Treaty becomes relevant with fair and competitive play.
[720] Castells, "The Global Network." Page 620

100,000 with all of the infield campers and RV's, the F1 venues began at about 150,000 with open ground seating, and the Le Mans race had at least 250,000 people per year.[721]

Fig. 7-1: Updated SAFER barrier construction as of 2016 at the "Bus Stop" in Watkins Glen. Photo courtesy of Josh Ashby (IMRRC)

In M/S there were many positive key points and momentum from the 1990s thrust the sport into corrective modes. Prior to Earnhardt's death the HANS device had been made available but most resisted and NASCAR did not mandate its use. This resistance would fall into what Pickering refers to as the "*sphere of culture"* whereby this culture was to side with the driver if they were not comfortable with something new.[722] It was soon mandated to be worn by all race drivers world-wide and has been responsible for saving many lives. The second item was development of SAFER barrier for NASCAR to absorb the energy of a 3400 pound car travelling at very high rate of speed and upgraded catch fencing to prevent incursion into spectator areas. However, demand exceeded supply and it would take years to install around every speedway in the NASCAR network.

[721] http://www.worldstadiums.com/stadium_menu/stadium_list/100000.shtml Accessed 2017, as well as https://en.wikipedia.org/wiki/List_of_motor_racing_venues_by_capacity Accessed 2018
[722] Pickering. Page 4, italics in original

Fig. 7-2: Heavily upgraded stanchions for catch fencing at WGI "Esses". Photo courtesy Josh Ashby (IMRRC)

By this time the heterogeneous network was much more clear. Enthusiast participants were consuming the sport and spending their money on not just tickets, hats, and T-shirts to signify their support of a driver or a team, but also on products advertised on various platforms during a race and, more importantly, on after-market equipment for their cars produced by specialty equipment manufacturers. Some of those producers also supplied M/S teams for those very components as well as more specialized items. Active participants combined those components with other parts they fabricated in-house to create a racecar which, if a part failed would affect the team by crashing the car and potentially harming the driver or simply damaging other parts but in either case the team would be injuriously harmed by poor race results. To mitigate safety issues, administrative participants established stronger regulations over the active participants. In F1 contests continued in the rain (up to a certain point) with the use of rain tires that had very deep grooves pushing water through at several gallons per rotation.[723] However, NASCAR could

[723] This was dependent upon manufacturer, tire pattern, compound and several other factors per venue

not ever compete in the rain as their premise was maximum speed on banked ovals thus several contests were delayed from Sunday into the workweek causing the majority of spectators to miss the event in-person and suffering the cost of no refund for their expense of hundreds of dollars. Like any outdoor sporting event that was simply the risk one accepted in buying tickets

After years of M/S enthusiast participants calling for some evidence of environmental responsibility on the part of M/S administrative participants, the FIA finally responded in the new century as it had become an $80-Billion per year global business with six countries producing 91-percent of global chassis' but only presenting 41-percent of the world's racing events.[724] Further, the acquisition of supercomputers and high-speed communication equipment in F1 created another network as the live data was streamed directly from the car to the paddock area for monitoring and passed through to the company headquarters for data gathering and future modeling opportunities through computational fluid dynamics. As a final point, the safety device known as HANS became mandatory worldwide despite resistance, once drivers accepted the scientifically proven fatal effects of high-velocity oblique impacts with immovable stationary objects such as concrete walls. Plus, the public outcry from M/S enthusiast participants and from the M/S media following the needless death of a seven-time champion was deafening.

Having examined this collection of large technical systems it has been shown that M/S became a transnational, heterogeneous network with multiple nodes, each having their own regional style, where multiple actors and hierarchical social groups involved with the

[724] Henry. Page x

technical and the non-technical worked in concert to make cars go faster than ever before while keeping the driver safe. Social and political power, held by different groups, shifted and was implemented unequally.

All of these groups of actors played significant roles in this evolution. The enthusiast participant comprising the moderately interested, the fervently interested, the sport media, and the media analysts with their technological enthusiasm. The active participant comprising the driver, crew, and team owner embracing the practice of how to manipulate science and a variety of technologies. The administrative participants in marketing and regulating the sport while maintaining the venues. What is truly astonishing, however, has been the realization of a bifurcated transparency regarding the regulations. The FIA has made technical and sporting rule books publicly available every year for all to read and understand. To the contrary, NASCAR has refused to – and still to this day will not – publish any rule book or its changes and tightly controls its distribution.

Finally, these competitions took place with machines that at any point could, and did, break changing the outcome for all actors. Consequences did not rest with just one team as cumulative season points were at stake. Climate and weather were also factors in that temperatures, humidity, barometric pressure, rain, affected the handling of those racecars. What had begun on the public space of roads transformed into highly technological systems on purpose-built spaces (even the temporary in Monaco was still purposely built for those four days). As stated, neither car nor driver were the heart of M/S history – it was all of the other factors, technical and non-technical, that coalesced in forming a heterogeneous network of M/S events and race spaces.

In closing, I am reminded of a phrase from an interview by Frank Ükötter with German historian Joachim Radkau. When asked what advice he might have for the audience, Radkau’s reply included, “I would like to see more transnational studies, comparisons and investigations that cross borders.”[725] I hope I have honored that request and accomplished what he requested.

[725] Frank Uekötter, "Interview with Joachim Radkau," *Environmental History* 13 (2008). Page 766

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